DECLARATION

I, TAKAO OCHI, a Japanese Patent Attorney registered No. 10149, of Okabe International Patent Office at No. 602, Fuji Bldg., 2-3, Marunouchi 3-chome, Chiyoda-ku, Tokyo, Japan, hereby declare that I have a thorough knowledge of Japanese and English languages, and that the attached pages contain a correct translation into English of the priority documents of Japanese Patent Application No. 2000-270226 filed on September 6, 2000 in the name of CANON KABUSHIKI KAISHA.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made, are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed this 24th day of November, 2004

Takao Ochi

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[Title of the Invention] Ink Jet Recording Head And Method For Manufacturing Ink Jet Recording Head

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[Name of the Document] Specification

[Title of the Invention] Ink Jet Recording Head And Method For Manufacturing Ink Jet Recording Head

[What is Claimed is]

[Claim 1]

An ink jet recording head comprising:

a recording element base plate provided with a plurality of recording elements for discharging recording liquid, and a plurality of supply ports arranged on the face opposite to the surface having said recording elements thereon for supplying said recording liquid to said recording elements;

at least one recording element unit having an opening portion for said recording element base plate to be incorporated, and a wiring base plate to apply electric pulses to said recording element base plate for discharging said recording liquid when being connected with said recording element base plate; and

a supporting member for holding and fixing said recording element base plate, wherein

said supporting member is provided with a plurality of supply flow paths for supplying said recording liquid to each of said supply ports of said recording element base plate, respectively, and the flow path width of each of said

supply flow paths is formed to be smaller than the opening width of inlet portion of each of said supply ports.

[Claim 2]

An ink jet recording head according to Claim 1, wherein each of said supply ports of said recording element base plate is formed in taper to make the width of flow path gradually smaller from the inlet portion of said supply port to the outlet portion.

[Claim 3]

An ink jet recording head according to Claim 1 or 2, wherein said recording element base plate and said supporting member are bonded by use of bonding agent.

[Claim 4]

An ink jet recording head according to Claim 3, wherein each step created between said supply flow paths and said supply ports is buried by said bonding agent.

[Claim 5]

An ink jet recording head according to Claim 3 or 4, wherein said bonding agent has the property of being hardened by the irradiation of ultraviolet rays and the property of being hardened by heating.

[Claim 6]

An ink jet recording head according to Claim 5, wherein said bonding agent is hardened by heating.

[Claim 7]

An ink jet recording head according to any one of

Claims 1 to 6, further comprising:

a supporting plate existing inclusively between said wiring base plate and said supporting member to hold and fix said wiring base plate.

[Claim 8]

A method for manufacturing an ink jet recording head provided with a recording element base plate provided with a plurality of recording elements for discharging recording liquid, and a plurality of supply ports arranged on the face opposite to the surface having said recording elements thereon for supplying said recording liquid to said recording elements; at least one recording element unit having an opening portion for said recording element base plated to be incorporated, and a wiring base plate to apply electric pulses to said recording element base plate for discharging said recording liquid when being connected with said recording element base plate; and a supporting member for holding and fixing said recording element base plate, comprising the following steps of:

coating on said supporting member the bonding agent having the property of being hardened by the irradiation of ultraviolet rays and the property of being hardened by heating;

forcing out said bonding agent from the bonding face of said recording element base plate and said supporting member by compressing said recording element base plate and

said supporting member to each other; and

positioning and fixing said recording element base plate to said supporting member by irradiating with ultraviolet rays said bonding agent forced out from said bonding face to harden said bonding agent.

[Claim 9]

A method for manufacturing an ink jet recording head according to Claim 8, wherein said coating step of coating said bonding agent on said supporting member is a step of coating said bonding agent on the bonding face of said recording element base plate and said supporting member.

[Claim 10]

A method for manufacturing an ink jet recording head according to Claim 9, wherein the step of coating said bonding agent on the bonding face of said recording element base plate and said supporting member includes a step of coating said bonding agent on the areas extended out from the bonding face of said recording element base plate and said supporting member.

[Claim 11]

A method for manufacturing an ink jet recording head according to Claim 10, wherein said recording element base plate is formed substantially in rectangle, and the extended areas from said bonding face are the areas extended in the longitudinal direction of said recording element base plate formed substantially in rectangle.

[Claim 12]

A method for manufacturing an ink jet recording head according to Claim 10, wherein said recording element base plate is formed substantially in rectangle, and the extended areas from said bonding face are the areas extended in the widthwise direction perpendicular to the longitudinal direction both on the edge portions in said longitudinal direction of said recording element base plate formed substantially in rectangle.

[Claim 13]

A method for manufacturing an ink jet recording head according to Claim 10, wherein said recording element base plate is structured with the array of plural discharge ports for discharging said recording liquid, and said extended areas from the bonding face are the areas extended out in the longitudinal direction of said discharge port array formed by plural discharge ports.

[Claim 14]

A method for manufacturing an ink jet recording head according to any one of Claims 8 to 13, further comprising the following steps of:

holding said recording element base plate by use of a vacuum adsorption chuck in the step of forcing out the bonding agent from the bonding face of said recording element base plate and said supporting member by compressing said recording element base plate and said supporting member

to each other; and

irradiating ultraviolet rays again to the portions blocked from said ultraviolet rays due to the existence of said vacuum adsorption chuck, among those portions of said bonding agent forced out from said bonding face in said step of positioning and fixing, after moving said vacuum adsorption chuck outside the irradiating area of said ultraviolet rays subsequent to the completion of said step of positioning and fixing.

[Claim 15]

A method for manufacturing an ink jet recording head according to Claim 14, wherein the portions of said bonding agent blocked from said ultraviolet rays due to the existence of said vacuum adsorption chuck are the portions arranged in said supply ports.

[Claim 16]

A method for manufacturing an ink jet recording head according to any one of Claims 8 to 15, wherein said bonding agent is coated by transfer.

[Claim 17]

A method for manufacturing an ink jet recording head according to any one of Claims 8 to 16, further comprising the step of:

thermally hardening said entirely coated bonding agent by further application of heating after said bonding agent is hardened by the irradiation of ultraviolet rays

to the bonding agent forced out from said bonding face.

[Claim 18]

A method for manufacturing an ink jet recording head according to any one of Claims 8 to 17, wherein the coating thickness of said bonding agent between said recording element base plate and said supporting member is 4 to 10 μm.

[Claim 19]

A method for manufacturing an ink jet recording head according to any one of Claims 8 to 18, wherein a supporting plate is arranged to inclusively exist between said wiring base plate and said supporting member to hold and fix said wiring base plate to said supporting member.

[Detailed Description of the Invention]

[0001]

[Field of the Industrial Utilization]

The present invention relates to an ink jet recording head, and a method for manufacturing an ink jet recording head.

[0002]

A liquid discharge recording apparatus is the recording apparatus of the so-called non-impact recording type which can perform recording at high speed and use various kinds of recording mediums for recording. Then, it is characterized in that almost no noise is generated at the time of recording. For this reason, a liquid discharge

recording apparatus is widely employed as an apparatus for carrying a recording mechanism such as a printer, a word processor, a facsimile machine, a copying machine, or the like.

[0003]

For the liquid discharge recording methods employed in a liquid discharge recording apparatus of the kind, there is, as the typical example thereof, a method that uses an electrothermal converting device as a discharge energy generating device. This method is adapted to discharge liquid droplets of a recording liquid from fine discharge ports to effect recording on a recording medium, and is generally comprised of a recording head having discharge nozzles for forming liquid droplets and a recording liquid supply system for supplying a recording liquid to this recording head. The liquid discharge recording head using an electrothermal converting device is provided with the electrothermal converting devices in each pressure chamber, and provides thermal energy for recording liquid by applying electric pulses, which serve as recording signals, to each of the electrothermal converting devices. This generates the phaseal changes of recording liquid, and then, the bubbling pressure of recording liquid exerted at the time of bubbling (at the time of boiling) is utilized for discharging recording liquid droplets.

[0004]

Further, of the liquid discharge recording heads that use the electrothermal converting method, there are the one that adopts the method in which recording liquid is discharged in parallel to the base plate having the electrothermal converting devices arranged therefor (edge shooter) and the one that adopts the method in which recording liquid is discharged perpendicularly to the base plate having the electro-thermal converting devices arranged therefor (side shooter).

[0005]

Fig. 26 is a view which shows the state where the recording element base plate, which constitutes the background art of the application hereof according to the prior application by the present applicant, is mounted on a supporting member. In Fig. 26, (a) is a plane view of the state and (b) is a sectional view taken along line A-A in (a).

[0006]

Each of first and second recording element base plates 102 and 103 is provided with electrothermal converting devices, has a mechanism of discharging a recording liquid, and is disposed on, as shown in (a) of Fig. 26, a supporting member 101. The recording element base plates 102 and 103 are bonded on the supporting member 101 by bonding resin, or the like. The supporting member 101 is formed of ceramics such as alumina (Al_2O_3), while each

of the recording element base plates 102 and 103 is formed of silicon (Si).

[0007]

As shown in (b) of Fig. 26, a plurality of discharge ports 104a for discharging recording liquid are arranged on the discharge port plate 104 ((b) of Fig. 26) provided for each of the recording element base plates 102 and 103 on the surface side to be open in two lines in a position to face the discharge energy generating devices (electrothermal converting devices, for example) 105, and each of the discharge port arrays 102a and 103b is structured to form one pair by two lines (see (a) of Fig. 26). At the center of each of the recording element base plates 102 and 103 on the back surface side thereof is provided with a recording liquid supply port 106 which is passed therethrough to supply a recording liquid to the discharge port 104a from a recording liquid supply flow path 101a of the supporting member 101 to have a length substantially equal to the length of each of the discharge port arrays 102a and 103a in the direction of the array.

[0008]

The recording liquid supply path 101a has a flow path width larger than the opening width of the inlet portion of the recording liquid supply port 106. As a result, the thickness of a partition wall 101b that partitions the recording supply paths 101a adjacent to each other is

smaller than the pitch between the inlet portions themselves of the recording liquid supply ports 106 adjacent to each other.

[0009]

There have been known several assembling methods or the like used for the manufacture of such recording element base plate as described above and the liquid discharge head that includes such base plate.

[0010]

For example, in the specification of Japanese Patent Laid-Open Application No. 09-187952, an assembling method is disclosed to position the recording element base plate with respect to a method for manufacturing a liquid discharge head. This assembling method is such as to position the recording element base plate in good precision by use of vacuum adsorption fingers, and then, to fix the recording element base plate by the application of bonding agent of the type that dually uses ultraviolet and thermal hardening.

[0011]

Also, in the specification of Japanese Patent Laid-Open Application No. 11-179923, a method is disclosed for bonding an orifice plate (discharge port plate) to the main body of a liquid discharge head.

[0012]

Also, in the specification of Japanese Patent

Laid-Open Application No. 11-188873, a method is disclosed for bonding a nozzle member to the main body of a liquid discharge head which is provided with a plurality of ink chambers.

[0013]

[Problems to be Solved by the Invention]

Of the recording element base plates described above, the second recording element base plate 103, which is provided with a plurality of discharge port arrays, in particular, makes it necessary to narrow the pitches each other for the recording liquid supply port 106 in a case where the number of recording element base plates is increased to implement the cost down when the base plates are cut out from one silicon wafer or where the number of discharge port arrays 103a is increased without making the recording element base plate larger.

[0014]

If the pitches between recording liquid supply ports 106 themselves are made smaller, there is a need for making the thickness smaller for the partition wall 101b of the supporting member 101 accordingly. However, if the partition wall 101b is made thinner, there are problems that may be encountered as given below.

(1) It becomes difficult for the ceramics supporting member 101 to form the thin partition wall less than a certain thickness from the viewpoint of manufacture.

(2) If the partition wall 101b is thin, the vibration waves are propagated to the adjacent supply flow path through the partition wall 101b when recording liquid is discharged. Then, in the adjacent supply flow path, the defective supply of recording liquid is caused to occur due to the propagated vibrations with the resultant printing defect.

(3) Further, if the partition wall 101b is thin, it becomes necessary to make the assembling precision higher for the recording element base plate 103 in relation to the supporting member 101 so as not to allow the adjunct supply flow paths 101a themselves to mix recording liquids.

[0015]

On the other hand, if the partition wall 101b is made too thick, the width of the supply flow path 101a becomes narrower to make it impossible to supply recording liquid to the recording liquid supply port 106 in a sufficient amount.

[0016]

Therefore, when the pitch between the recording supply ports themselves should made smaller, it is necessary to determine the thickness of the partition wall 101b to be formed in the supporting base plate 101 and the width of the supply flow path 101a in consideration of those aspects described above.

[0017]

Also, for the assembling method or the like described above, which is used for the manufacture of the recording element base plate and the manufacture of the liquid discharge head that includes that of the recording element base plate, the following drawback is encountered:

(1) Of the locations having thereon the bonding agent of ultraviolet and thermal hardening dual type coated, the irradiated ultraviolet rays do not reach the locations in shadows of the adsorption fingers that adsorb the recording element base plate. As a result, the recording element base plate is transferred to the next hardening process while the positioning fixation has not been completed, and the positioning of the recording element base plate is deviated eventually.

(2) The viscosity of the bonding agent of ultraviolet and thermal hardening dual type applied on the location where irradiated ultraviolet rays do not reach as described above is made extremely low immediately before hardening in the thermal hardening step, and then, due to the capillary force, it is transferred to the corner portions inside the recording liquid flow path. As a result, discharge nozzles are clogged.

[0018]

The present invention has been contrived taking the above problems into consideration, and an object thereof is to provide an ink jet recording head which is capable

of optimizing the discharge characteristics of recording liquid and the supply characteristics thereof, as well as the positioning precision of a recording element base plate to a supporting member when the pitches between the recording liquid supply ports are made smaller and the discharge port arrays are arranged at a high density.

[0019]

Another object of the present invention is to provide a method for manufacturing an ink jet recording head which is capable of improving the reliability of the ink jet recording head.

[0020]

[Means for Solving the Problems]

In order to achieve the object described above, according to the present invention, there is provided an ink jet recording head comprising: a recording element base plate provided with a plurality of recording elements for discharging recording liquid, and a plurality of supply ports arranged on the face opposite to the surface having the recording elements thereon for supplying the recording liquid to the recording elements; at least one recording element unit having an opening portion for the recording element base plated to be incorporated, and a wiring base plate to apply electric pulses to the recording element base plate for discharging the recording liquid when being connected with the recording element base plate; and a

supporting member for holding and fixing the recording element base plate, wherein the supporting member is provided with a plurality of supply flow paths for supplying the recording liquid to each of the supply ports of the recording element base plate, respectively, and the flow path width of each of the supply flow paths is formed to be smaller than the opening width of inlet portion of each of the supply ports.

[0021]

According to an ink jet recording head of the present invention structured as described above, a partition wall for separating a plurality of supply flow paths formed on the supporting member from each other is formed to be thicker than the distance between inlet portions of support ports which are adjacent to each other on the recording element base plate, so that a vibration wave upon discharge of the recording liquid is prevented from being transmitted to an adjacent supply flow path through the partition walls, whereby it is possible to improve the discharge performance of the recording liquid. Also, not so high precision is required for positioning the partition wall and the area between the supply ports since the partition wall is formed to have the thickness greater than the distance between the inlet portions of the adjacent supply ports, so that it is no longer required to improve the assembling precision of the recording element base pate with respect to the

supporting member unnecessarily.

[0022]

It may be arranged such that each of the supply ports of the recording element base plate is formed in taper to make the width of flow path gradually smaller from the inlet portion of the supply port to the outlet portion.

[0023]

Also, it may be arranged such that the recording element base plate and the supporting member are bonded by use of bonding agent.

[0024]

Furthermore, it is rendered possible to prevent liquid from being stagnant between the support port of the recording element base plate and the supply flow path of the supporting member so as to avoid deterioration of the supplying performance of the recording liquid when it is arranged such that each step created between the supply flow paths and the supply ports is buried by the bonding agent.

[0025]

Furthermore, it may be arranged such that the bonding agent has the property of being hardened by the irradiation of ultraviolet rays and the property of being hardened by heating. According to the preset invention, since the width of the flow path of the supply flow path of the supporting member is formed to be smaller than the width of the opening of the inlet portion of the supply port

of the recording element base plate, as described above, the step which is created between the supply port of the recording element base plate and the supply flow path of the supporting member is formed on the upper surface side of the supporting member, that is, on the side facing the supply port of the recording element base plate. For this reason, the bonding agent forced out from the bonding face between the recording element base plate and the supporting member can be irradiated with the ultraviolet rays which advances into the supply port through the outlet portion of the supply port. Then, this forced out bonding agent is hardened by ultraviolet rays, whereby it is rendered possible to prevent the bonding agent which has been incompletely hardened from flowing out into the flow path.
[0026]

Further, it may be arranged such that the bonding agent is hardened by heating. It is rendered possible to securely bond the recording element base plate and the supporting member together by thermally hardening the bonding agent, in addition to harden it with ultraviolet rays.
[0027]

Further, it may be arranged such that the ink jet recording head further comprises a supporting plate existing inclusively between the wiring base plate and the supporting member to hold and fix the wiring base plate.

[0028]

Also, according to the present invention, there is provided a method for manufacturing an ink jet recording head provided with a recording element base plate provided with a plurality of recording elements for discharging recording liquid, and a plurality of supply ports arranged on the face opposite to the surface having the recording elements thereon for supplying the recording liquid to the recording elements; at least one recording element unit having an opening portion for the recording element base plated to be incorporated, and a wiring base plate to apply electric pulses to the recording element base plate for discharging the recording liquid when being connected with the recording element base plate; and a supporting member for holding and fixing the recording element base plate, comprising the following steps of: coating on the supporting member the bonding agent having the property of being hardened by the irradiation of ultraviolet rays and the property of being hardened by heating; forcing out the bonding agent from the bonding face of the recording element base plate and the supporting member by compressing the recording element base plate and the supporting member to each other; and positioning and fixing the recording element base plate to the supporting member by irradiating with ultraviolet rays the bonding agent forced out from the bonding face to harden the bonding agent.

[0029]

According to the present invention described above, it is rendered possible to prevent a positional displacement between the recording element base plate and the supporting member when the recording element base plate is positioned with respect to the supporting member by positioning and fixing the recording element base plate with respect to the supporting member by hardening the bonding agent forced out from the bonding face and thereafter the recording element base plate is moved into a heating furnace in order to perform a thermal hardening step of the bonding agent.

[0030]

Also, it may be arranged such that the coating step of coating the bonding agent on the supporting member is a step of coating the bonding agent on the bonding face of the recording element base plate and the supporting member.

[0031]

Further, it may be arranged such that the step of coating the bonding agent on the bonding face of the recording element base plate and the supporting member includes a step of coating the bonding agent on the areas extended out from the bonding face of the recording element base plate and the supporting member.

[0032]

Further, it may be arranged such that the recording element base plate is formed substantially in rectangle,

and the extended areas from the bonding face are the areas extended in the longitudinal direction of the recording element base plate formed substantially in rectangle.

[0033]

Or, it may be arranged such that the recording element base plate is formed substantially in rectangle, and the extended areas from the bonding face are the areas extended in the widthwise direction perpendicular to the longitudinal direction both on the edge portions in the longitudinal direction of the recording element base plate formed substantially in rectangle.

[0034]

Or, it may be arranged such that the recording element base plate is structured with the array of plural discharge ports for discharging the recording liquid, and the extended areas from the bonding face are the areas extended out in the longitudinal direction of the discharge port array formed by plural discharge ports.

[0035]

Also, it is preferable to employ such a structure that the method for manufacturing an ink jet recording head further comprises the following steps of: holding the recording element base plate by use of a vacuum adsorption chuck in the step of forcing out the bonding agent from the bonding face of the recording element base plate and the supporting member by compressing the recording element base

plate and the supporting member to each other; and irradiating ultraviolet rays again to the portions blocked from the ultraviolet rays due to the existence of the vacuum adsorption chuck, among those portions of the bonding agent forced out from the bonding face in the step of positioning and fixing, after moving the vacuum adsorption chuck outside the irradiating area of the ultraviolet rays subsequent to the completion of the step of positioning and fixing. With this structure, it is rendered possible to harden the bonding agent in the portions blocked from the ultraviolet rays so as to position and fix the supporting member and the recording element base plate more securely.

[0036]

Further, the portions of the bonding agent blocked from the ultraviolet rays due to the existence of the vacuum adsorption chuck may be the portions arranged in the supply ports.

[0037]

Furthermore, it may be arranged such that the bonding agent is coated by transfer.

[0038]

Also, since the method for manufacturing an ink jet recording head further comprises the step of thermally hardening the entirely coated bonding agent by further application of heating after the bonding agent is hardened by the irradiation of ultraviolet rays to the bonding agent

forced out from the bonding face, the recording element base plate is completely bonded to the supporting member.

[0039]

Further, it is preferable that the coating thickness of the bonding agent between the recording element base plate and the supporting member is 4 to 10 μm.

[0040]

Furthermore, it may be arranged such that a supporting plate is arranged to inclusively exist between the wiring base plate and the supporting member to hold and fix the wiring base plate to the supporting member.

[0041]

[Detailed Description of the Preferred Embodiments]

Now, with reference to the accompanying drawings, the description will be made of the embodiments in accordance with the present invention.

[0042]

(First Embodiment)

Fig. 1 to Fig. 6 are views which illustrate the head cartridge, the recording head, and the ink tanks, respectively, embodying the present invention or to which the present invention is applicable, and the relationships between them as well. Hereunder, with reference to Fig. 1 to Fig. 6, each of the constituents will be described.

[0043]

As understandable form Fig. 1 and Fig. 2, the

recording head H1001 of the present invention is one constituent that forms a recording head cartridge H1000. The recording head cartridge H1000 comprises the recording head H1001, and the ink tanks H1900 (H1901, H1902, H1903, and H1904) which are detachably mountable on the recording head H1001. The recording head cartridge H1000 is supported to be fixed on the main body of an ink jet recording apparatus by positioning means and electrical contacts of a carriage (not shown), while being detachably mountable on the carriage. The ink tank H1901 is for black ink use, the ink tank H1902 for cyan ink use, the ink tank H1903 for magenta ink use, and the ink tank H1904 for yellow ink use. In this manner, the ink tanks H1901, H1902, H1903, and H1904 are detachably mountable on the recording head H1001, respectively, and each of the tanks is made replaceable to reduce the running costs of image recording by the ink jet recording apparatus.

[0044]

Next, the detailed description will be made of the recording head H1001 per constituent that forms the recording head one after another.

[0045]

<1> Recording head

The recording head H1001 is the one which is called side shooter type using the bubble jet type that records using electrothermal converting devices to generate thermal

energy for creating film boiling in ink in accordance with electric signals.

[0046]

As shown in Fig. 3 which is an exploded perspective view, the recording head H1001 comprises a recording element unit H1002; an ink supply unit H1003; and a tank holder H2000.

[0047]

Further, as shown in Fig. 4 which is also an exploded perspective view, the recording element unit H1002 comprises a first recording element base plate H1100; a second recording element base plate 1101; a first plate H1200; an electric wiring tape H1300; an electric contact board H2200; and a second plate H1400. Also, the ink supply unit H1003 comprises an ink supply member H1500; a flow path formation member H1600; a joint rubber H2300; a filter H1700; and a sealing rubber H1800.

[0048]

<1 - 1> Recording element unit

Fig. 5 is a partly exploded perspective view which shows the first recording element base plate H1100.

[0049]

For the first recording element base plate H1100, the ink supply port H1102 is formed by the elongated through opening as the ink flow path on the Si base plate H1110 of 0.5 mm to 1.0 mm thick, for example, by means of anisotropic etching utilizing the Si crystal orientation, sand blasting,

or the like. Then, on both sides across the ink supply port H1102, each of the electrothermal converting devices H1103, which serves as recording element, is arranged in zigzag each in one line. The electrothermal converting devices H1103 and the electric wiring of Al or the like that supply electric power to each of the electrothermal converting devices H1103 are formed by means of film formation technique. Further, the electrode unit H1104 that supplies electric power to the electric wiring is arranged each on the outer side of each electrothermal converting device H1103, and the bumps H1105 of Au or the like are formed for the electrode units H1104, respectively. Then, on the Si base plate, the ink flow path walls H1106 and the discharge ports H1107 are formed with resin material by means of photolithographic technique for the formation of ink flow paths corresponding to the electrothermal converting devices H1103, hence forming the discharge port array H1108. Therefore, ink supplied from the ink flow path H1102 is discharged by means of bubbles which are generated by each electrothermal converting device H1103, because each discharge port is arranged to face each electro- thermal converting device H1103.

[0050]

Also, Fig. 6 is a partly broken perspective view which shows the second recording element base plate H1101.

[0051]

The second recording element base plate H1101 is the one for discharging ink of three colors. Three ink supply ports H1102 are formed in parallel, and electrothermal converting devices and ink discharge ports are formed on both sides having each of the ink supply ports between them. In the same manner as forming the first recording element base plate H1100, the ink supply ports, electrothermal converting devices, electric wiring, electrodes, and others are formed on the Si base plate, of course, and the ink flow paths and ink discharge ports are formed on them with resin material by use of photolithographic technique.

[0052]

Then, as in the case of the first recording element base plate, the electrode unit H1104 and the bumps H1105 of Au or the like are formed to supply electric power to the electric wiring.

Here, reverting to Fig. 4, the first plate H1200 is formed by Alumina (Al_2O_3) material of 0.5 to 10 mm thick, for example. In this respect, the material of the first plate is not necessarily limited to alumina, but it may be possible to produce this plate with the material which has the same linear expansion coefficient as that of the material of the recording element base plate H1100, and also, has the same heat conductivity as more than that of the material of the recording element base plate H1100. The

material of the first plate H1200 may be either one of silicon (Si), aluminum nitride (AlN), zirconium, silicon nitride (Si_3N_4), silicon carbide (SiC), molybdenum (Mo), and tungsten (W), for example. For the first plate H1200, there are formed the ink supply port H1201 for supplying black ink to the first recording element base plate H1100, and the ink supply ports H1201 for supplying cyan, magenta, and yellow ink to the second recording element base plate H1101. Then, the ink supply ports 1102 of the recording element base plate correspond to the ink supply ports H1201 of the first plate H1200, respectively, and then, the first recording element base plate H1100 and the second recording element base plate H1101 are positioned and bonded to the first plate H1200 to be fixed in good precision. Here, it is desirable to use the first bonding agent H1202 which has low viscosity with low hardening temperature so that it can be hardened in a short period of time, while having a relatively high hardness after hardened, as well as, a good resistance to ink. Such first bonding agent H1202 is, for example, a thermal hardening bonding agent having epoxy resin as its main component, and the thickness of the bonded layer should preferably be 50 μm or less.

[0053]

The electric wiring tape H1300 is for the application of electric signals to the first recording element base plate H1100 and the second recording element

base plate H1101 in order to discharge ink, and comprises a plurality of opened parts for incorporating each of the recording element base plates; electrode terminals H1302 corresponding to the electrode units H1104 on the respective recording element base plates; and the electrode terminal units H1303 to effectuate the electrical connection with the electric contact base plate H2200 which are provided with the external signal input terminals H1301 positioned on the edge portion of the wiring tape to receive electric signals from the apparatus main body. The electrode terminal H1302 and the electrode terminal 1303 are connected by use of a continuous wiring pattern of copper foil.

[0054]

The electric wiring tape H1300, the first recording element base plate 1100, and the second recording element base plate H1101 are connected electrically, respectively. The connecting method is, for example, such that the electrode unit 1104 of the recording element base pate and the electrode terminal H1302 of the electric wiring tape H1300 are electrically coupled by means of thermo-ultrasonic pressurized welding.

[0055]

The second plate H1400 is, for example, one-sheet plate member of 0.5 to 1.0 mm thick, and formed by metallic material, such as ceramics of alumina (Al_2O_3), Al, SUS, or the like. Then, this plate is configured to be provided with

the opening portion larger than the contour dimension of the first recording element base plate H1100 and the second recording element base plate H1101 bonded and fixed to the first plate H1200, respectively, and also, bonded to the first plate H1200 by use of the second bonding agent H1203 so that the electric wiring tape H1300 can be electrically connected with the first recording element base plate H1100 and the second recording element base plate H1101 on the plane, thus bonding and fixing the reverse side of the electric wiring tape H1300 by use of the third bonding agent H1306.

[0056]

The electrically connected portions of the first recording element base plate H1100, the second recording element base plate H1101, and the electric wiring tape H1300 are sealed by a first sealant H1307 (not shown), and second sealant H1308 in order to protect the electrically connected portions from erosion due to ink, and external shocks as well. The first sealant seals mainly the reverse side of the connected portion between the electrode terminal H1302 of the electric wiring tape and the electrode unit H1105 of the recording element base plate, and the outer circumferential portion of the recording element base plate. The second sealant seals the surface side of the aforesaid connected portion.

Further, the electric contact base board H2200,

which is provided with the external signal input terminal H1301 to receive electric signals from the apparatus main body, is electrically connected with the edge portion of the electric wiring tape by means of thermally pressurized bonding using anisotropic conductive film or the like.

Then, the electric wiring tape H1300 is folded on one side face of the first plate H1200 to be bonded to the side face of the first plate H1200 by use of the third bonding agent H1306. The third bonding agent H1306 is, for example, a thermo-hardening bonding agent of 10 to 100 μm thick with epoxy resin as its main component, for example.

[0057]

<1 - 2> Ink supply unit

The ink supply member H1500 is formed by means of resin molding, for example. For the resin material thereof, it is desirable to use the resin material in which glass filler is mixed in 5 to 40% for the enhancement of the form robustness.

[0058]

As shown in Fig. 7, the ink supply member H1500 is one of the constituents to form the ink supply unit H1003 that conducts ink from the ink tanks H1900 to the recording element unit H1002, and the ink flow paths H1501 are formed when the flow path formation member H1600 is welded thereto by means of ultrasonic welding. Also, to the joint H1517 that coupled with the ink tanks H1900, the filter H1700 is

bonded by means of welding in order to prevent the external dust particles from entering them. Further, in order to prevent ink evaporation from the joint H1517, a sealing rubber H1800 is provided therefor.

[0059]

Also, the ink supply member H1500 is partly functioned to hold the freely detachable and attachable ink tanks H1900, and also, provided with the first hole H1503 which engages with the second nail H1910 of the ink tanks H1900.

[0060]

Also, as shown in Fig. 4, there are provided an installation guide H1601 to guide the recording head cartridge H1000 to the position of the carriage installation on the main body of an ink jet recording apparatus; the coupling portion H1508 where the recording head cartridge is installed and fixed to the carriage by use of a head set lever; an abutting portion H1509 for positioning the carriage in a designated position of installation in the direction X (carriage scanning direction); an abutting portion H1510 in the direction Y (recording medium carrying direction); and an abutting portion H1511 in the direction Z (ink discharging direction). Also, it is arranged to provide the terminal fixing portion H1512 that positions and fixes the electric contact base plate H2200 of the recording element unit H1002. Then, with of a plurality of

ribs arranged for the terminal fixing portion H1512 and the circumference thereof, the robustness is enhanced for the surface where the terminal fixing portion H1512 is provided.

[0061]

<1 - 3> Coupling of the recording head unit and the ink supply unit

As shown in Fig. 3, the recording head H1001 is completed by bonding the recording unit H1001 with the ink supply unit H1003, and further with the tank holder H2000. The bonding is executed as follows:

[0062]

The ink supply port (ink supply port H1201 of the first plate H1200) of the recording element unit H1002 and the ink supply port (ink supply port H1601 of the liquid flow path formation member H1600) of the ink supply unit H1003 should be communicated without causing any ink leakage. To this end, each of them is fixed by use of screws H2400 to be fixed under pressure with the joint rubber H2300 between them. Here, at the same time, the recording element unit H1002 is positioned and fixed exactly to the standard positions of the ink supply unit in the direction X, direction Y, and direction Z.

[0063]

Then, the electric contact base plate H1301 of the recording element unit H1002 is positioned and fixed to one side face of the ink supply member H1500 by use of the

terminal positioning pins H1515 (two locations) and the terminal positioning holes H1309 (two locations). The fixing method is, for example, such as to caulk and fix the terminal coupling pins H1515 which is provided for the ink supply member H1500, but any other fixing means may be usable. Fig. 8 shows the finished condition.

[0064]

Further, the coupling hole and coupling portion of the ink supply member H1500 with the tank holder are fitted into and coupled with the tank holder H2000 to complete the recording head H1001. Fig. 9 shows the completion thereof.

[0065]

<2> Recording head cartridge

Fig. 1 and Fig. 2 are views which illustrate the installation of the recording head H1001 and ink tanks H1901, H1902, H1903, and H1904 which constitute a recording head cartridge H1000. Inside the ink tanks H1901, H1902, H1903, and H1904, ink of each corresponding color is contained, respectively. Also, as shown in Fig. 7, inside each of the ink tanks, the ink supply port H1907 is formed to supply ink retained in the ink tank to the recording head H1001. For example, when the ink tank 1901H is installed on the recording head H1001, the ink supply port H1907 of the ink tank H1901 is in contact under pressure with the filter H1700 installed for the joint portion H1520 of the recording head H1001. Then, black ink in the ink tank H1901 is supplied

to the first recording element base plate from the ink supply port H1907 through the first plate H1200 by way of the ink flow path H1501 of the recording head H1001.

[0066]

Then, ink is supplied to the bubbling chamber where the electrothermal converting device H1103 and the discharge port H1107 are arranged, and ink is discharged toward a recording sheet serving as a recording medium by the application of thermal energy generated by the electrothermal converting device H1103.

[0067]

Next, of the manufacturing process of a recording head structured as described above, the description will be made of the step of fixing the first recording element base plate H1100 to the first plat H1200.

[0068]

Then, (a) to (c) of Fig. 10, (d) and (e) of Fig. 11, and (f) and (g) of Fig. 12 are cross-sectional views which illustrate the method for manufacturing the ink jet recording head in accordance with one embodiment of the present invention. In this respect, Fig. 10 to Fig. 12 represent the section of the first recording element base plate H1100, taken in the longitudinal direction of the discharge port array thereof.

[0069]

In Fig. 10 to Fig. 12, a reference mark H101

designates the transfer pin that coats bonding agent H1202; H106, the vacuum adsorption finger that adsorbs and positions the recording element base plate; H110 and H111, the CCD cameras that recognize the position of the recording element base plate; and H112 and H113, ultraviolet irradiation nozzles, respectively.

[0070]

In the step of fixing the first recording element base plate H1100 to the first plate H1200, the bonding agent H1202 is at first coated on the transfer surface of the transfer pin H101 as shown in (a) of Fig. 10. Then, in continuation, as shown in (a) of Fig. 10, the transfer surface of the transfer pin H101 is in contact with the first plate H1200. Then, as shown in (c) of Fig. 10, when the transfer pin H101 is released from the first plate H1200, the bonding agent H1202 is coated on the bonding locations of the first plate H1200.

[0071]

At this juncture, it is arranged so as to transfer the bonding agent H1202 on the first plate H1200 to the position which shifts outside the position where the first recording element base plate H1100 is in contact. The bonding agent is dual type of ultraviolet and thermal hardening, that is, the bonding agent can be hardened by the irradiation of ultraviolet rays, and also, by application of heat. The bonding agent thus used has also

excellent resistance to ink, and excellent transferability as well.

[0072]

Next, as shown in (d) of Fig. 11, the surface of the ink flow path wall H1106 that forms the discharge port H1107 of the first recording element base plate H1100 is held by the vacuum adsorption finger H106, and the alignment mark (not shown) of the first recording element base plate H1100 is optically recognized by the CCD cameras H110 and H111 to position it with the first plate H1200.

[0073]

In continuation, as shown in (e) of Fig. 11, the vacuum adsorption finger H106 thus positioned descends to enable the first recording element base plate H1100 to abut upon the first plate H1200 and compress them. Then, the bonding agent H1202 is forced out to the edge portions of the first recording element base plate H1100 in the longitudinal direction as shown in (e) of Fig. 11.

[0074]

Then, as shown in (f) of Fig. 12, the bonding agent H1202 forced out from the edge portions is hardened by the irradiation of ultraviolet rays from the ultraviolet irradiation nozzles H112 and H113, while keeping the first recording element base plate H1100 to be compressed to the first plate H1200. Thus, the first recording element base plate H1100 is positioned and fixed on the first plate H1200.

[0075]

Further, after the vacuum is released and the vacuum adsorption finger H106 is moved, ultraviolet rays are again irradiated by the ultraviolet irradiation nozzles H112 and H113 from the surface of the discharge port H1107 as shown in (g) of Fig. 12, thus hardening the bonding agent H1202 which is slightly forced out in the ink flow path (particularly, in the ink supply port H1102) in order to prevent the bonding agent from flowing out to clog the ink flow paths and discharge ports.

[0076]

After the bonding process, this assembled part is further heated in order to harden the bonding agent H1202 yet to be hardened in the locations where the ultraviolet rays cannot reach.

[0077]

Fig. 13 is a perspective view which shows the first recording element base plate H1100 in the process of assembling represented in (e) of Fig. 11.

[0078]

As shown in Fig. 13, the bonding agent H1202 is forced out from the edge portions of the first recording element base plate H1100 in the longitudinal direction.

[0079]

Fig. 14 is a perspective view which shows the second recording element base plate H1101 in the state represented

in (e) of Fig. 11 in the process of assembling.

[0080]

The second recording element base plate H1101 is also positioned and fixed on the first plate H1200 in the same process as the process described above. The bonding agent H1202 is forced out form the edge portions of the second recording element base plate H1101 in the longitudinal direction.

[0081]

In this respect, if the thickness of the bonding agent is less than 4 μm after hardening, there is a fear that bonding defect occurs, and if the thickness of the bonding agent is more than 10 μm, the heat radiation is blocked from the recording element base plate to the first plate, and there is a fear that ink is not discharged normally. Therefore, it is desirable to set the thickness of the bonding agent H1202 between the recording element base plates H1100 and H1101, and the first plate H1200 at a value within a range of approximately 4 μm to 10 μm.

[0082]

(Second Embodiment)

Figs. 15 to 17 are views for explaining an ink jet recording head according to a second embodiment of the present invention. Fig. 15 is an exploded perspective view of an ink jet recording head of the second embodiment of the present invention, Fig. 16 is a perspective view of a

recording element base plate in the ink jet recording head shown in Fig. 15, and Fig. 17 is a perspective view for showing the ink jet recording head of the second embodiment in its completed state.

[0083]

As shown in Fig. 15 and the other drawings, the ink jet recording head of the present embodiment has six ink flow paths and a recording element base plate H1100' has six nozzle arrays.

[0084]

Also in the ink jet recording head thus structured, when the recording element base plate H1100' is positioned and fixed to the first plate H1200 by bonding, a bonding agent H1202 is coated in such a manner that the bonding agent H1202 is forced out to the end portions in the longitudinal direction of the nozzle array H1107 of the recording element base plate H1100', as shown in Fig. 16, in the same process of the assembling method as that of the first embodiment which is described with reference to Figs. 10 to 12. This forced out bonding agent H1202 is irradiated with ultraviolet rays.

[0085]

(Third Embodiment)

Figs. 18 to 23 are views for explaining an ink jet recording head according to a third embodiment of the present invention.

[0086]

Fig. 18 is a view for showing a recording element base plate in the ink jet recording head according to the third embodiment of the present invention. In Fig. 18, (a), (b) and (c) are respectively a plane view, a bottom view, and a side view of the recording element base plate. Fig. 19 is a perspective view for showing a recording element unit in the ink jet recording head according to the present embodiment, and Fig. 20 is an exploded perspective view of the ink jet recording head which is provided with the recording element unit shown in Fig. 20.

[0087]

As shown in Fig. 18, a through hole (recording liquid supply port) H3 is formed on the recording element base plate H1 for supplying a recording liquid from the back surface thereof. A plurality of electrothermal converting devices (not shown) for applying discharge energy to the recording liquid are provided respectively on the both sides of the through hole H3 on the surface of the recording element base plate H1. A discharge plate (not shown) is provided on the surface of the base plate H1. This discharge plate is formed with a plurality of discharge ports H2 to be opposite to the plurality of electrothermal converting devices, respectively. Then, on the both end portions of the surface of the base plate H1, there are provided a plurality of electrodes (not shown) which are electrically connected to

the plurality of electrothermal converting devices, respectively.

[0088]

Also as shown in Fig. 19, the plurality of electrodes provided on the recording element base plate H1 and a plurality of electrode leads (not shown) provided on the wiring base plate H4 are electrically connected to each other by, for example, a TAB technology, so as to constitute a recording element unit H6. The wiring base plate H4 transmits an electric signal for discharging the recording liquid to the recording element base plate H1. An entire electrical connection part between the recording element base plate H1 and the wiring base plate H4 is coated with sealing resin H5 in order to be protected from a breaking down of the wire due to corrosion by the recording liquid or a force acting externally.

[0089]

As shown in Fig. 20, the ink jet recording head of the present embodiment comprises three recording element units H6a, H6b and H6c shown in Fig. 19, a supporting plate H8 for holding these recording element units and a supporting member H7 to which the wiring base plates H4 and the supporting plate H8 are bonded. The supporting member H7 is provided with a wiring integration base plate H10 for integrating electric signals transmitted to the wiring base plates H4a to H4c.

[0090]

Note that the size of an opening portion of each of the wiring base plates H4a to H4c and that of an opening portion of the supporting plate 8 are substantially equal and is slightly larger than each of the recording element base plates H1a to H1c. A sealing resin and a filling assisting member (both not shown) fill a portion without any of the recording element base plates H1a to H1c provided, out of the openings of the supporting plate H8.

[0091]

Next, description will be made on a method for assembling an ink jet recording head structured as described above.

[0092]

First, a heat generating resistance layer and a wiring (not shown) are patterned on a silicon wafer by photolithographic technology. Next, a nozzle wall (not shown) and the discharge port H2 are formed of photosensitive resin, and then the recording liquid supply port H3 is formed by anisotropic etching, sandblasting, or the like. After that, the wafer is cut and divided to manufacture the recording element base plates H1a to H1c.

[0093]

Next, the recording element base plates H1a to H1c are electrically connected to the wiring base plates H4a to H4c, respectively, by the TAB assembling technology, and

a sealing resin 5 is coated on electric signal input terminals on the side of the recording element base plates H1a to H1c and on leads on the side of the wiring base plates H4a to H4c.

[0094]

Next, the recording element base plate H1a to H1c are bonded and fixed to the supporting member 7, and the wiring base plate H4a to H4c are bonded and fixed to the supporting member H8 by bonding resin, whereby the recording element units H6a to H6c which are comprised of the recording element base plates H1a to H1c and the wiring base plates H4a to H4c are fixed to the main body of the ink jet recording head which is comprised of the supporting member H7 and the supporting plate H8.

[0095]

Then, the wiring base plate H4a to H4c and the wiring integration plate H10 are electrically connected to each other and the wiring integration base plate H10 is fixedly held by the supporting member H7.

[0096]

By the above-described steps, as shown in (a) of Fig. 21, the ink jet recording head of the present embodiment is manufactured. Note that in the ink jet recording head of the present embodiment, as shown in (b) of Fig. 21, the bonding agent H1202 is forced out in the width direction of the recording element base plate H1.

[0097]

Here, detailed description will be made on a step of bonding and fixing the recording element base plates H1a to H1c to the supporting member H7.

[0098]

Fig. 22 is a plane view for showing a bonding agent coated area of the supporting member to which the recording element base plate is bonded.

[0099]

As shown in Fig. 22, the bonding agent H1202 is transferred onto an area indicated by a dotted line on the supporting member 7. In Fig. 22, a rectangular area indicated by a solid line is a portion to which the recording element base plate H1 is positioned and bonded. An area coated with the bonding agent is extended in the width direction from this rectangular area in the both end portions (in a upper side portion and a lower side portion in the drawing) in the longitudinal direction.

[0100]

The recording element base plate H1 is positioned on the supporting member H7 in the same manner as that in the first embodiment. On this occasion, as shown in Fig. 23, the bonding agent H1202 is extended in the width direction of the recording element base plate H1 at the both end portions in the longitudinal direction of the rectangular area, and this extended bonding agent H1202 is

irradiated with ultraviolet rays to be hardened.

[0101]

As described above, the recording element base plates H1a to H1c and the wiring base plates H4a to H4c are electrically bonded to each other with the leads by the use of the TAB assembling technology, and this connection portion is coated with the sealing resin H5. For this reason, when the bonding agent H1202 is forced out in the longitudinal direction at the both end portions of the recording element base plate 1 in the longitudinal direction in the same manner as in the first and second embodiments, the forced out bonding agent H1202 is hidden behind the sealing resin H5 so that the ultraviolet rays do not reach the bonding agent H1202. Taking this condition into consideration, in the present embodiment, the bonding agent H1202 is arranged to be forced out in the width direction of the recording element base plate H1 at the both end portions in the longitudinal direction of the rectangular area.

[0102]

Note that the area coated with the bonding agent may be extended in any area other than the above-described area. The area is may be extended in the longitudinal direction of the above-described rectangular area, or may be extended in the longitudinal direction of the array of the discharge ports H2 provided on the recording element

base plate 1.

[0103]

(Fourth Embodiment)

Fig. 24 is a cross-sectional view which shows the recording element included in an ink jet recording head in accordance with a fourth embodiment of the present invention in a state where it is mounted on a supporting member.

[0104]

The recording element base plate 1 is arranged on the supporting member 2 with the function to discharge recording liquid by means of the electrothermal converting devices provided therefor. The recording element base plate 1 is bonded to the supporting member 2 by use of bonding resin or the like. The supporting member 2 is formed by ceramics, such as alumina (Al_2O_3), and the recording element base plate 1 is formed by silicon (Si).

[0105]

Also, for the discharge port plate 3 provided for the recording element base plate 1 on the surface side, a plurality of discharge ports 3a are open in two lines in the position to face the discharge energy generating devices (electrothermal converting devices, for example) 4 which serve as recording elements. Then, the discharge port array is formed in the two lines that make a pair. On the central part of the recording element base plate 1 on the reverse side, each of the recording liquid supply port 5 is open

in a length which is almost the same length of each discharge port array in the arrangement direction, which penetrates the supporting member 2 in order to supply recording liquid from the recording liquid supply flow path 2a to the discharge port 3a.

[0106]

For the present embodiment, the recording liquid supply system is structured to be arranged in high density, but the main consideration is given as follows:

(1) The recording liquid supply flow path 2a should have a width good enough to supply a sufficient amount of recording liquid to the recording liquid supply port 5.

(2) The partition wall 2b of the supporting member 2 is not allowed to propagate any unfavorable influence of vibration waves to the adjacent supply flow paths 2a when recording liquid is discharged.

(3) The required assembling precision should not become too high when the recording element base plate 1 is assembled with the supporting member 2.

[0107]

Consequently, each of the recording liquid supply paths 2a of the present embodiment has a width which is smaller than the opening width of the inlet portion of each of the recording liquid supply ports 5, and the thickness of each partition wall 2b that partitions the adjacent recording supply flow paths 2a is made larger than the pitch

between the inlet portions themselves of the adjacent recording liquid supply ports 5. More specifically, the width A of the recording liquid supply path 2a of the present embodiment is set at 0.6 mm; the thickness B of the partition wall 26, 0.63mm; the pitch C between the inlet portions themselves of the adjacent recording liquid supply ports 5, approximately 0.25 mm. Also, each of the supply ports 5 is formed in taper making the flow path width smaller as being away from the supply port 5 toward the outlet portion. Here, for the present embodiment, a five-liquid flow path system is exemplified, but the number of liquid flow paths for the system is not necessarily limited thereto.

[0108]

In accordance with the present embodiment, the partition wall 2b is arranged to be thicker than the pitch between the inlet portions themselves of the adjacent recording liquid flow paths 5. Therefore, it becomes possible to suppress the propagation of vibration waves that may be carried to the adjacent supply flow paths 2a through the partition wall 2b when recording liquid is discharged, thus enhancing the discharging performance of recording liquid. Also, with the partition wall 2b arranged in a thickness larger than the pitch between adjacent recording liquid supply ports 5 themselves, there is no need for making the assembling precision high for the recording element base plate 1 with respect to the supporting member 2.

[0109]

Fig. 25 is a cross-sectional view which illustrates the step of bonging the recording element base plate and the supporting member represented in Fig. 24.

[0110]

For the present embodiment, the bonding agent 10 of ultraviolet (UV) light hardening type is used for bonding the recording element base plate 1 and the supporting member 2. Then, with the bonding agent 10, the step that may be created between the recording element base plate 1 and the supporting member 2 is buried to prevent unwanted liquid pools, as well as bubble pools, from being generated in the recording liquid residing in each supply flow path.

[0111]

The bonding agent 10 coated on the bonding face between the recording element base plate 1 and the supporting member 2 is forced out between the upper face of the supporting member 2 and the side face of the recording liquid supply port 5, respectively, as shown in Fig. 25, when the recording element base plate 1 and the supporting member 2 are pressed to each other. Ultraviolet rays are irradiated from above the recording element base plate 1 to the bonding agent 10 thus forced out. Then, the bonding agent 10 is hardened, and consequently, the adjacent flow paths 2a themselves are sealed more reliably. Here, the discharge port plate 3 is formed by transparent resin

material or the like, thus making it possible to transmit ultraviolet rays. Also, the ultraviolet rays scatters when transmitted through the discharge port plate 3, and further, being diffused when reflected from the surface of the recording liquid supply port 5 and recording liquid supply flow path 2a, the ultraviolet rays reach the bonding agent 10.

[0112]

For the present embodiment, the width of the recording liquid supply flow path 2a is made smaller than the opening width of the inlet portion of the recording liquid supply port 5. There occurs steps that may becomes liquid pools of recording liquid on each bonding portion between the supporting member 2 and the recording element base plate 1. However, as described above, each of these steps is buried with the forced-out bonding agent 10, and then, such bonding agent 10 can be hardened by the irradiation of ultraviolet rays from above the recording element base plate 1. Therefore, even if the structure is arranged to make the width of the recording liquid supply flow path 2a smaller than the opening width of the inlet portion of the recording liquid supply port 5, there is no possibility that liquid pools are formed in the recording liquid in the supply path. Thus, the supply performance of recording liquid is not spoiled at all.

[0113]

In this respect, the bonding agent 10 usable for the present embodiment is not necessarily limited to the type of ultraviolet hardening only. If the bonding agent 10 of dual type of ultraviolet and thermal hardening is used, the bonding agent 10 is heated in addition to the irradiation of ultraviolet rays to the bonding agent 10 as described above, thus hardening the bonding agent 10 more reliably.

[0114]

[Effect of the Invention]

As described above, since in the ink jet recording head of the present invention the supporting member is provided with a plurality of supply flow paths for supplying a recording liquid to each supply port of a recording element base plate and the flow path width of each supply flow path is formed to be smaller than the opening width of an inlet portion of each supply port, a partition wall for separating the plurality of supply flow paths formed on the supporting member from each other is formed to be thicker than the distance between inlet portions of support ports which are adjacent to each other on the recording element base plate. As a result, it is possible to suppress the propagation of vibration waves which are created upon discharge of the recording liquid to the adjacent supply flow paths through the partition wall, thus enhancing the discharging performance of the recording liquid. Further, not so high precision is required for positioning the partition wall

and the area between the supply ports, so that it is no longer required to improve the assembling precision of the recording element base pate with respect to the supporting member unnecessarily.

[0115]

Further, with the structure that the recording element base plate and the supporting member are bonded to each other with the bonding agent and the step that may be created between the supply flow path and the support port is buried with this bonding agent, it is possible to prevent liquid pools from being generated between the supply port of the recording element base plate and the supply flow path of the supporting member, thereby preventing deterioration of the supplying performance of the recording liquid.

[0116]

Furthermore, since this bonding agent is arranged to have the property of being hardened upon irradiation with ultraviolet rays and of being hardened by heating, it is possible to harden the bonding agent which is forced out from the bonding face between the recording element base plate and the supporting member by irradiating this bonding agent with ultraviolet rays. Thus, it is possible to prevent a bonding agent which has been incompletely hardened from being flowing into the flow path.

[0117]

Also, the method for manufacturing the ink jet

recording head of the present invention comprises the step of coating on the supporting member the bonding agent having the property of being hardened by the irradiation of ultraviolet rays and the property of being hardened by heating, the step of forcing out the bonding agent from the bonding face of the recording element base plate and the supporting member by compressing the recording element base plate and the supporting member to each other, and the step of positioning and fixing the recording element base plate to the supporting member by irradiating with ultraviolet rays the bonding agent forced out from the bonding face to harden the bonding agent, so that it is possible to prevent a positional displacement of the recording element base plate with respect to the supporting member from being generated after the positioning of the recording element base plate with respect to the supporting member.

[Brief Description of the Drawings]

[Figure 1]

A perspective view which shows the state where a recording head and ink tanks are assembled for a recording head cartridge in accordance with one embodiment of the present invention.

[Figure 2]

A view which shows the state where the recording head and the ink tanks are separated for the recording head cartridge in accordance with one embodiment of the present

invention.

[Figure 3]

An exploded perspective view which shows the recording head cartridge represented in Fig. 1.

[Figure 4]

An exploded perspective view which shows the ink supply unit and the recording element unit represented in Fig. 3.

[Figure 5]

A partly broken perspective view which shows a part of the first recording element base plate represented in Fig. 4.

[Figure 6]

A partly broken perspective view which shows a part of the second recording element base plate represented in Fig. 4.

[Figure 7]

A cross-sectional view which shows the recording head cartridge represented in Fig. 1.

[Figure 8]

A perspective view which shows a device for coupling the recording element unit and the ink supply unit of the recording head cartridge represented in Fig. 1.

[Figure 9]

A perspective view which shows the bottom end of the recording head cartridge represented in Fig. 1.

[Figure 10]

Cross-sectional views which illustrate a method for manufacturing an ink jet recording head in accordance with one embodiment of the present invention.

[Figure 11]

Cross-sectional view which illustrate the method for manufacturing an ink jet recording head in accordance with one embodiment of the present invention.

[Figure 12]

Cross-sectional view which illustrate the method for manufacturing an ink jet recording head in accordance with one embodiment of the present invention.

[Figure 13]

A perspective view which shows a first recording element base plate represented in (e) of Fig. 11 in the assembling step.

[Figure 14]

A perspective view which shows a second recording element base plate represented in (e) of Fig. 11 in the assembling step.

[Figure 15]

An exploded perspective view which shows an ink jet recording head according to the second embodiment of the present invention.

[Figure 16]

A perspective view which shows a recording element

base plate in inkjet recording head shown in Fig. 15.

[Figure 17]

A perspective view which shows the ink jet recording head of the second embodiment in its completed state.

[Figure 18]

Views which show a recording element base plate in an ink jet recording head according to the third embodiment of the present invention.

[Figure 19]

A perspective view which shows a recording element unit in the ink jet recording head according to the third embodiment of the present invention.

[Figure 20]

An exploded perspective view of an ink jet recording head which is provided with the recording element unit shown in Fig. 19.

[Figure 21]

A perspective view (a) which shows the ink jet recording head according to the third embodiment of the present invention, and a cross-sectional view which shows a bonding portion between the recording element base plate and the supporting member in the ink jet recording head according to the third embodiment of the present invention.

[Figure 22]

A plane view which shows a bonding agent coated area of the supporting member to which the recording element base

plate is bonded.

[Figure 23]

A view for explaining a direction in which the bonding agent is forced out.

[Figure 24]

A cross-sectional view which shows the state that a recording element contained in an ink jet recording head according to the fourth embodiment of the present invention is mounted on the supporting member.

[Figure 25]

A cross-sectional view for explaining the bonding step for the recording element base plate and the supporting member shown in Fig. 24.

[Figure 26]

A view which shows the state that the recording element base plate is mounted on the supporting member, according to the previous application by the present applicant which is the related background art of the application hereof.

[Description of Reference Numerals or Symbols]

1 ... recording element base plate

2 ... supporting member

2a ... recording liquid supply flow path

2b ... partition wall

3 ... discharge port plate

3a ... discharge port

4 … discharge energy generating device

5 … recording liquid supply port

10 … bonding agent

H1, H1a, H1b, H1c … recording element base plates

H2 … discharge port

H3 … recording liquid supply port

H4, H4a, H4b, H4c … wiring base plates

H5 … sealing resin

H6, H6a, H6b, H6c … recording element units

H7 … supporting member

H8 … supporting plate

H10 … wiring integration base plate

H101 … transfer pin

H106 … vacuum adsorption finger

H110, H111 … CCD cameras

H112, H113 … ultraviolet irradiation nozzles

H1000 … recording head cartridge

H1001 … recording head

H1002 … recording element unit

H1003 … ink supply unit

H1100, H1100' … first recording element base plates

H1101 … second recording element base plate

H1102 … ink supply port

H1103 … electrothermal converting device

H1104 … electrode

H1105 … bump

H1106 … ink flow path wall

H1107 … discharge port

H1108 … discharge port array

H1110 … Si base plate

H1200 … first plate

H1201 … ink supply port

H1202 … bonding agent

H1300 … electric wiring tape

H1301 … external signal input terminal

H1302 … electrode terminal

H1303 … electrode terminal units

H1307 … first sealant

H1308 … second sealant

H1309 … terminal positioning hole

H1310 … terminal coupling hole

H1400 … second plate

H1500 … ink supply member

H1501 … ink flow path

H1502 … tank positioning hole

H1503 … first hole

H1504 … second hole

H1509 … X abutting portion

H1510 … Y abutting portion

H1511 … Z abutting portion

H1512 … terminal fixing portion

H1515 … terminal positioning pin

H1516 … terminal coupling pin

H1520 … joint

H1600 … flow path formation member

H1601 … installation guide

H1602 … ink supply port

H1700 … filter

H1800 … sealing rubber

H1900 … ink tank

H1901 … black ink tank

H1902 … cyan ink tank

H1903 … magenta ink tank

H1904 … yellow ink tank

H1907 … ink supply port

H1908 … tank positioning pin

H1909 … first nail

H1910 … second nail

H1911 … third nail

H1912 … movable lever

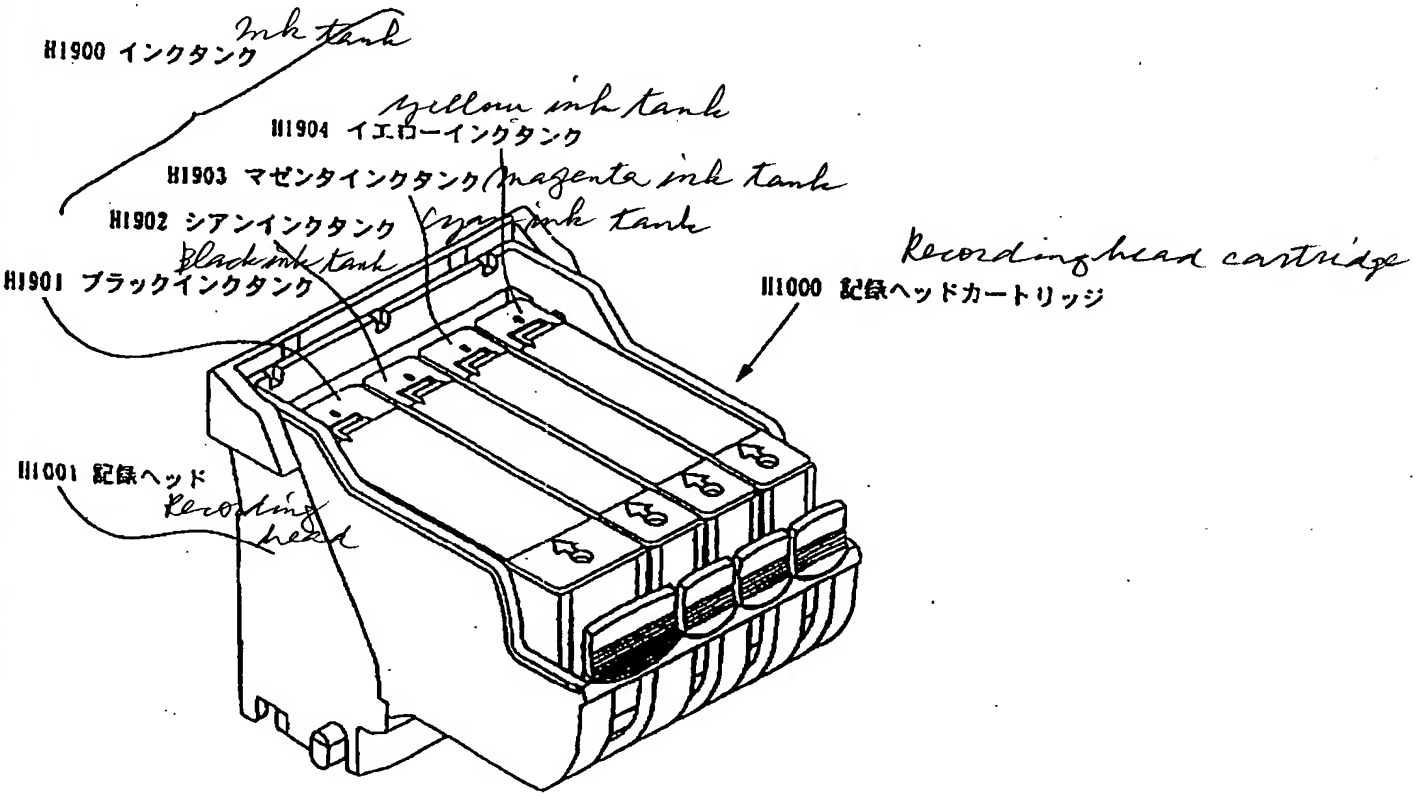
H2000 … tank holder

H2300 … joint rubber

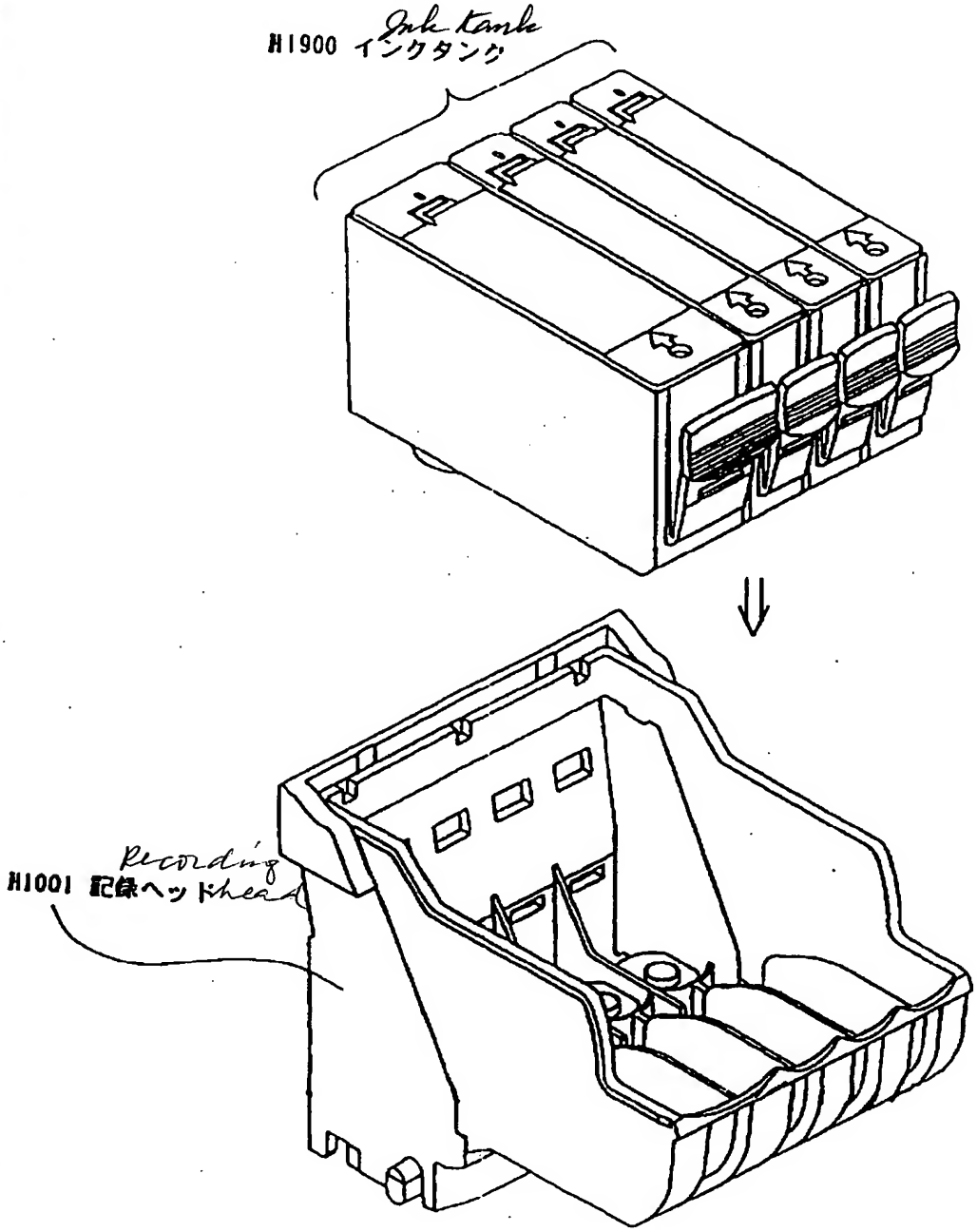
H2400 … screw

【書類名】　図面　[Name of the Document] Drawings

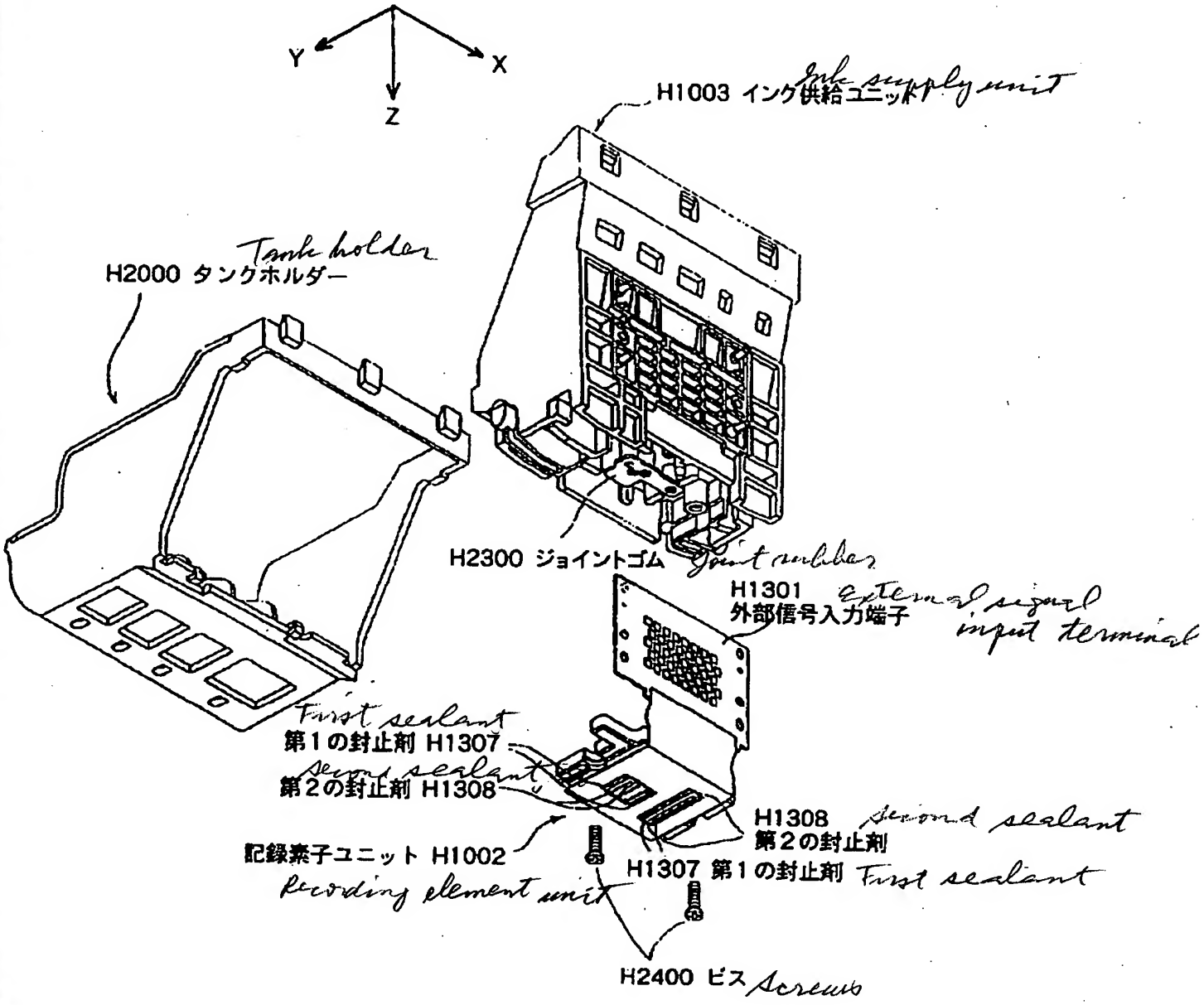
【図１】 Fig. 1



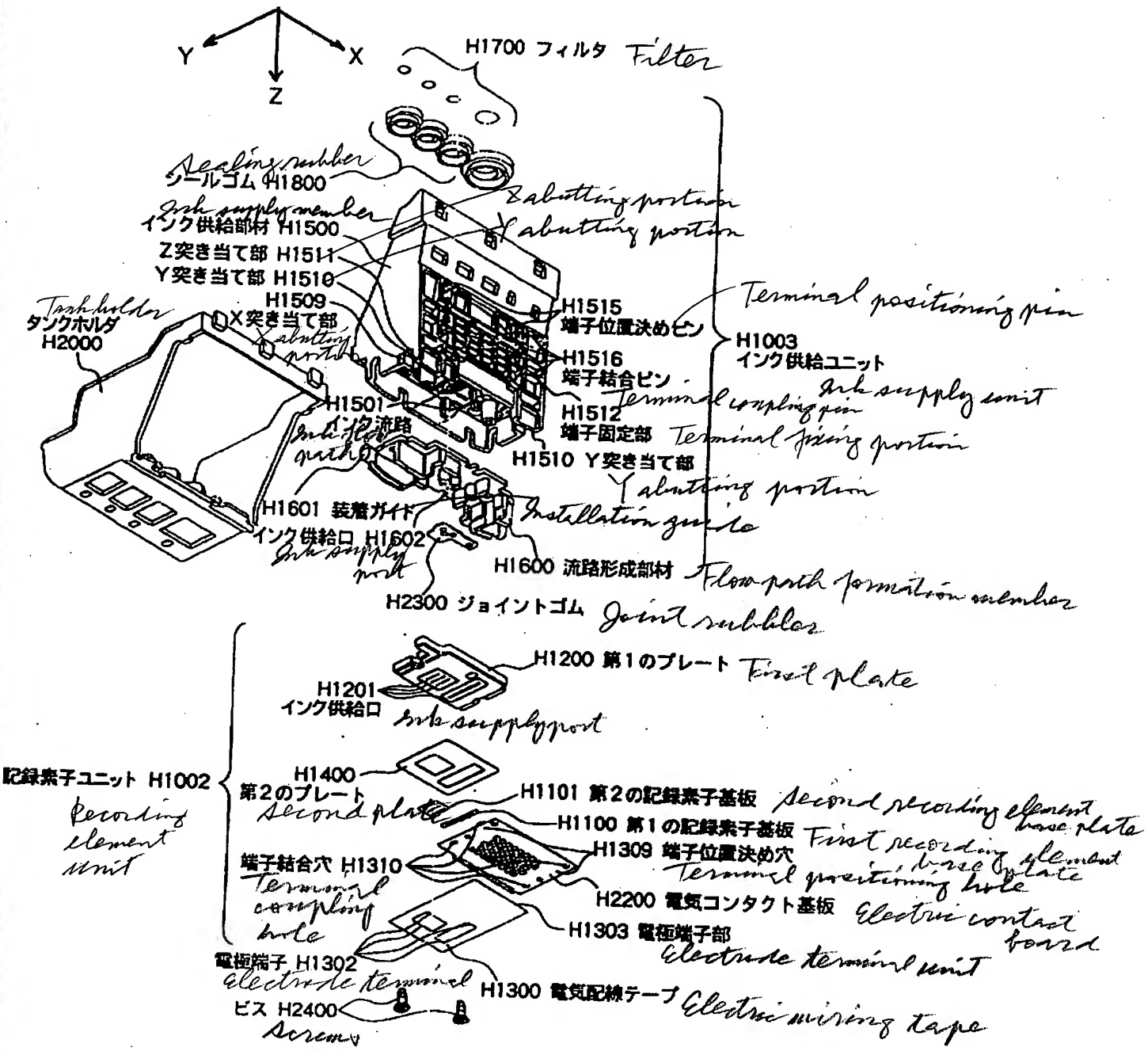
【図２】　Fig 2



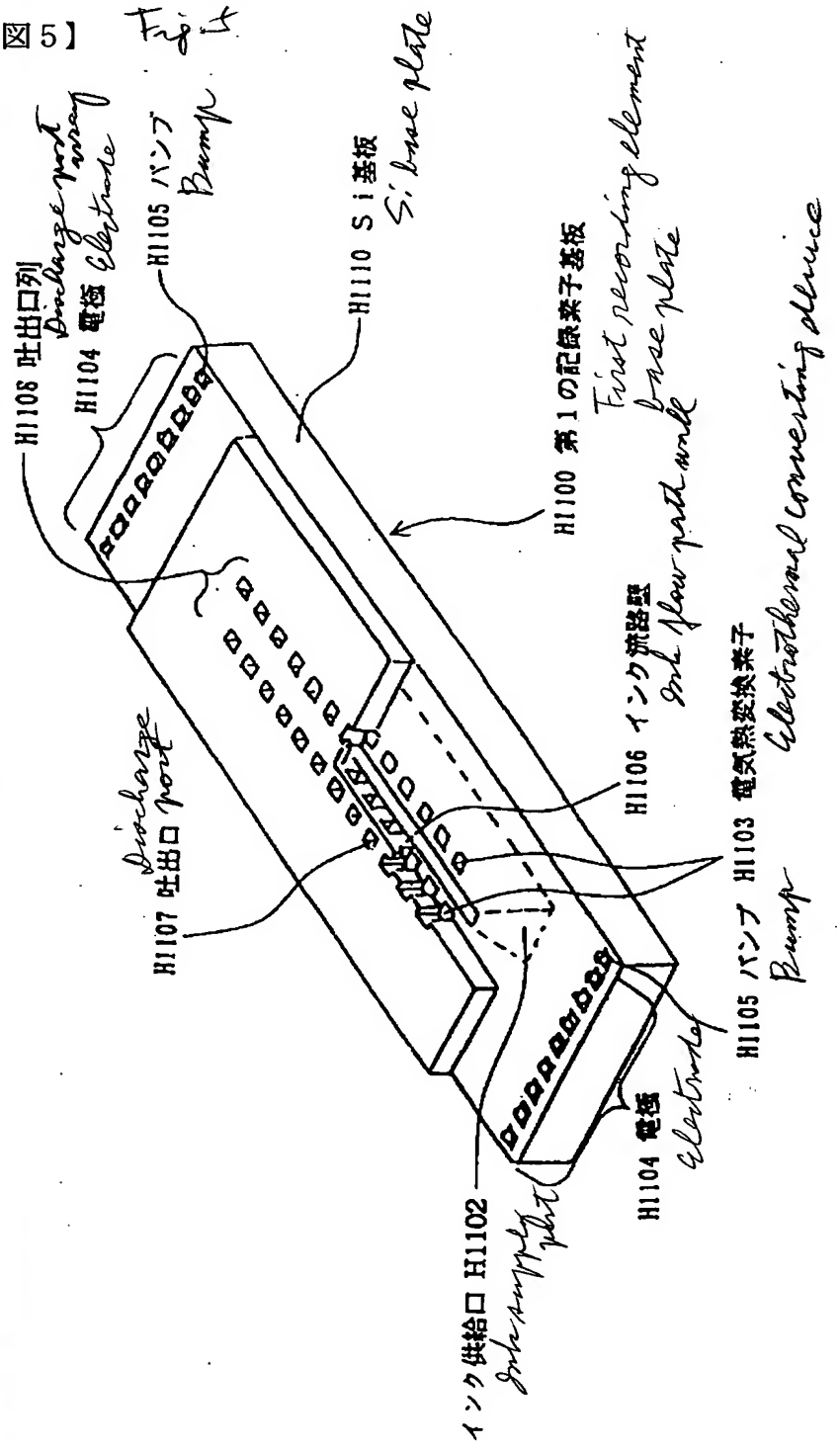
【図３】　Fig.3



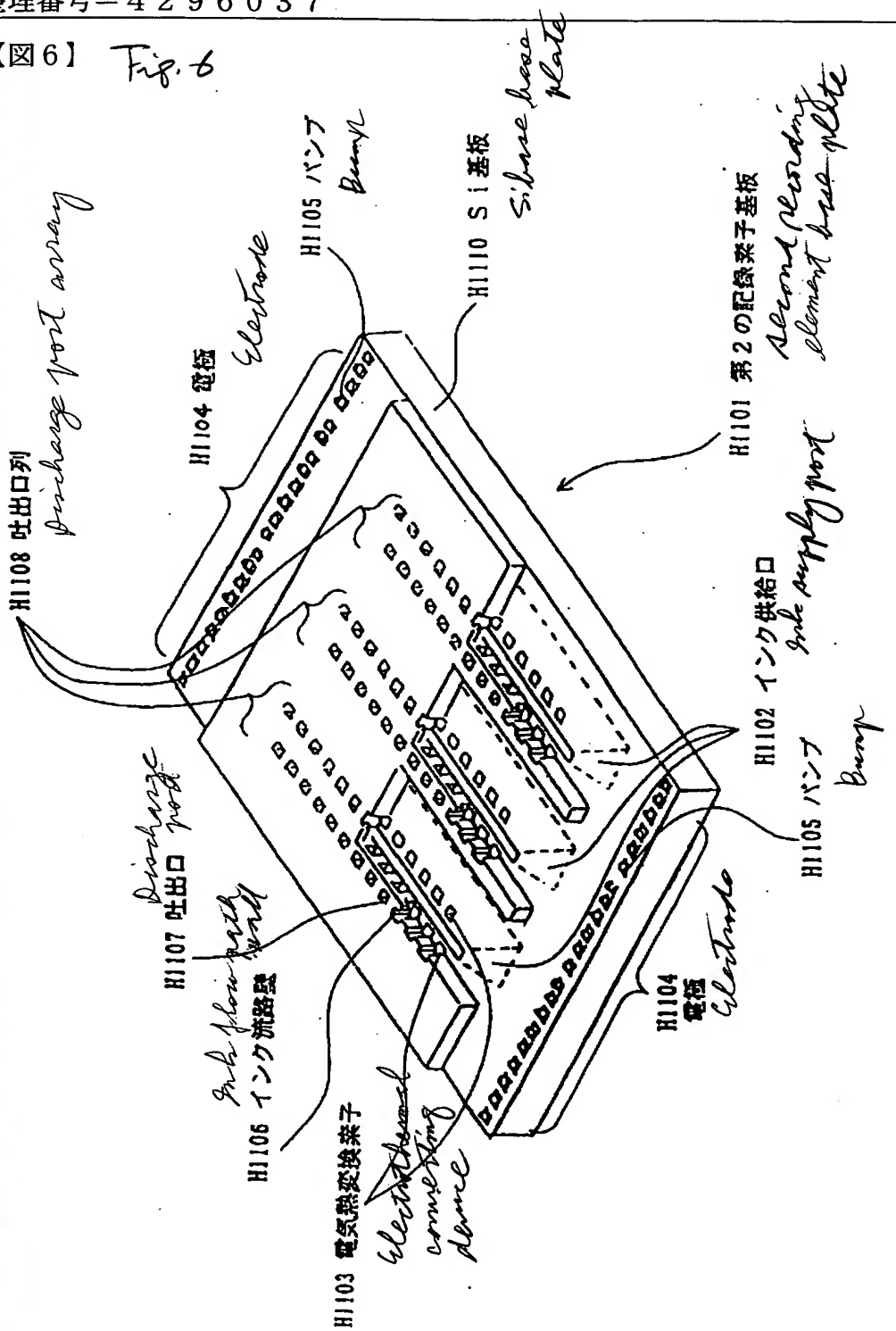
【図４】 Fig. 4



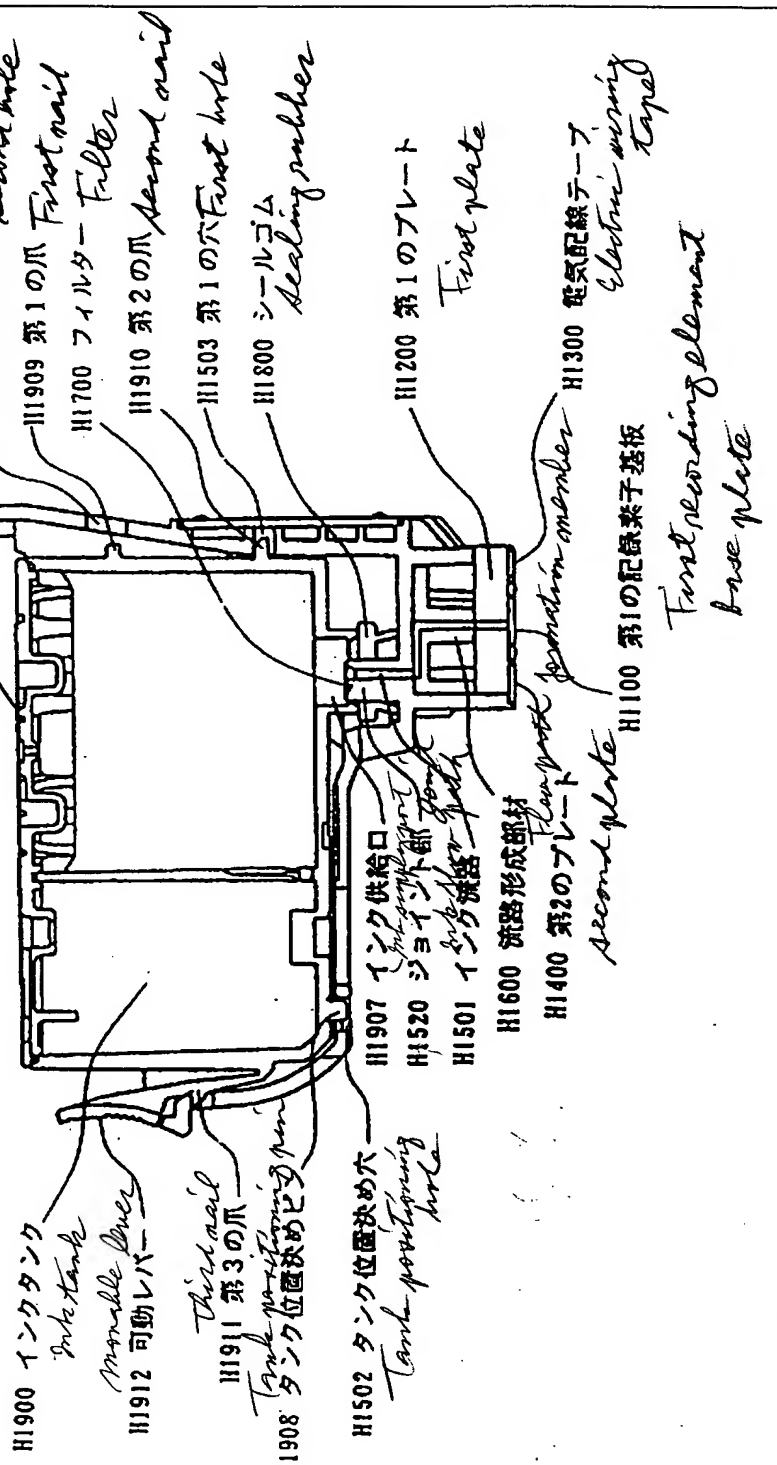
【図５】



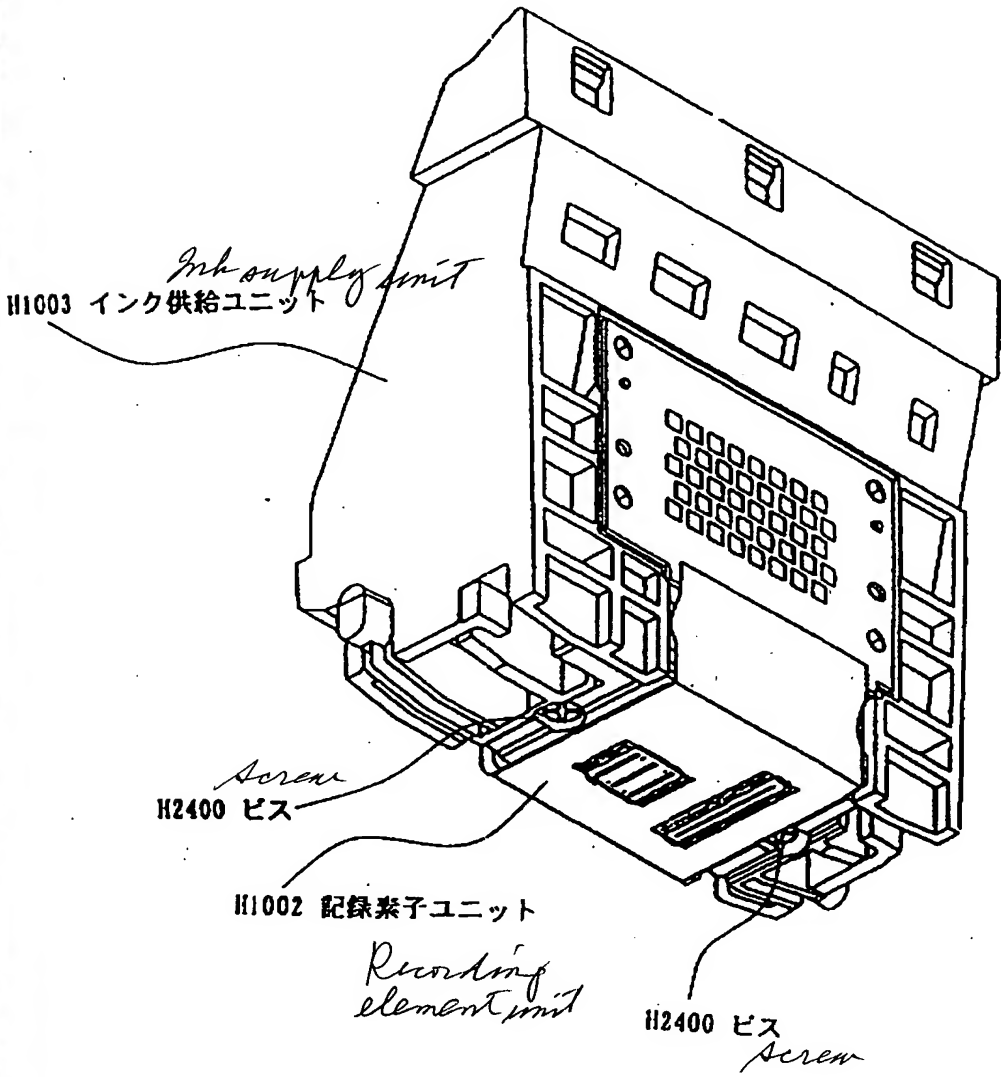
【図6】 Fig. 6



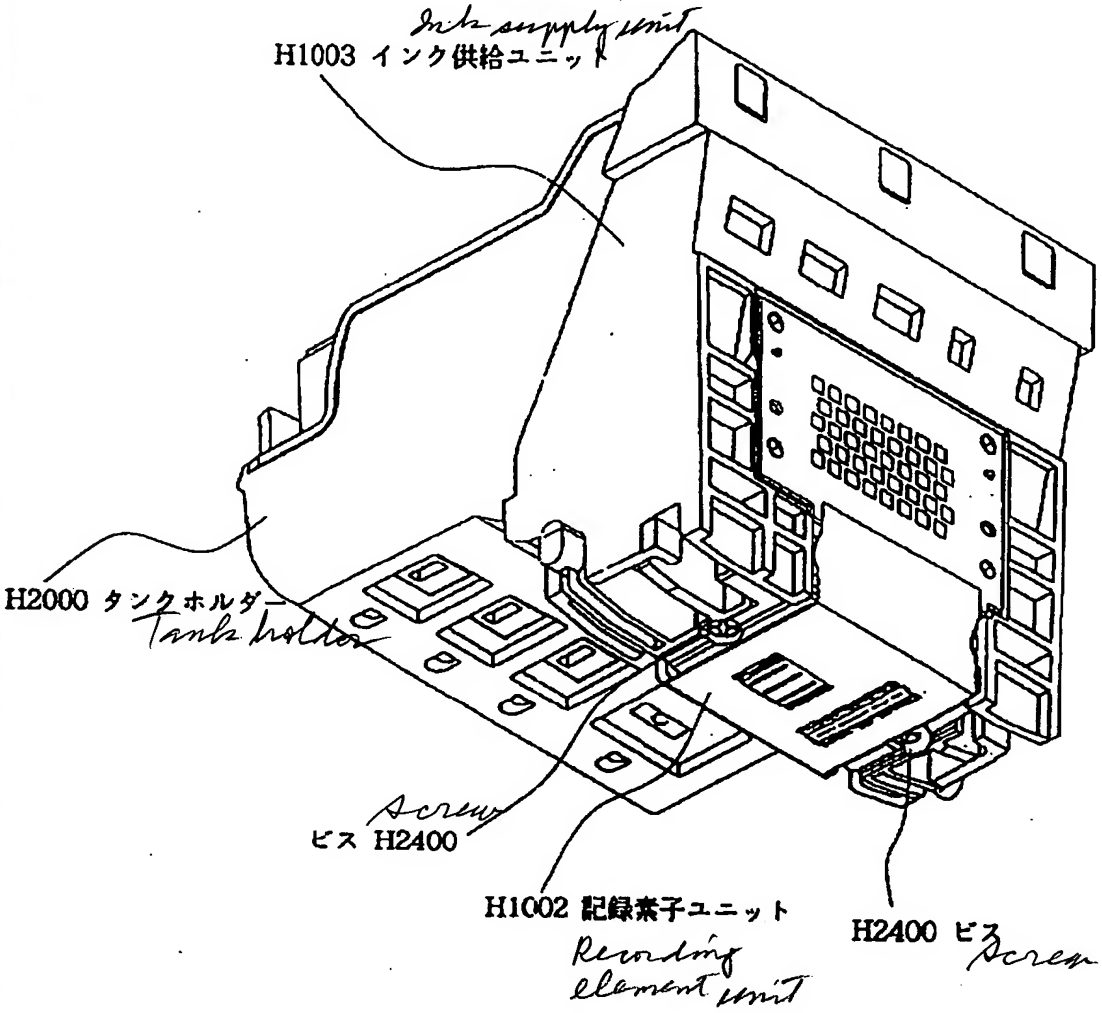
【図７】



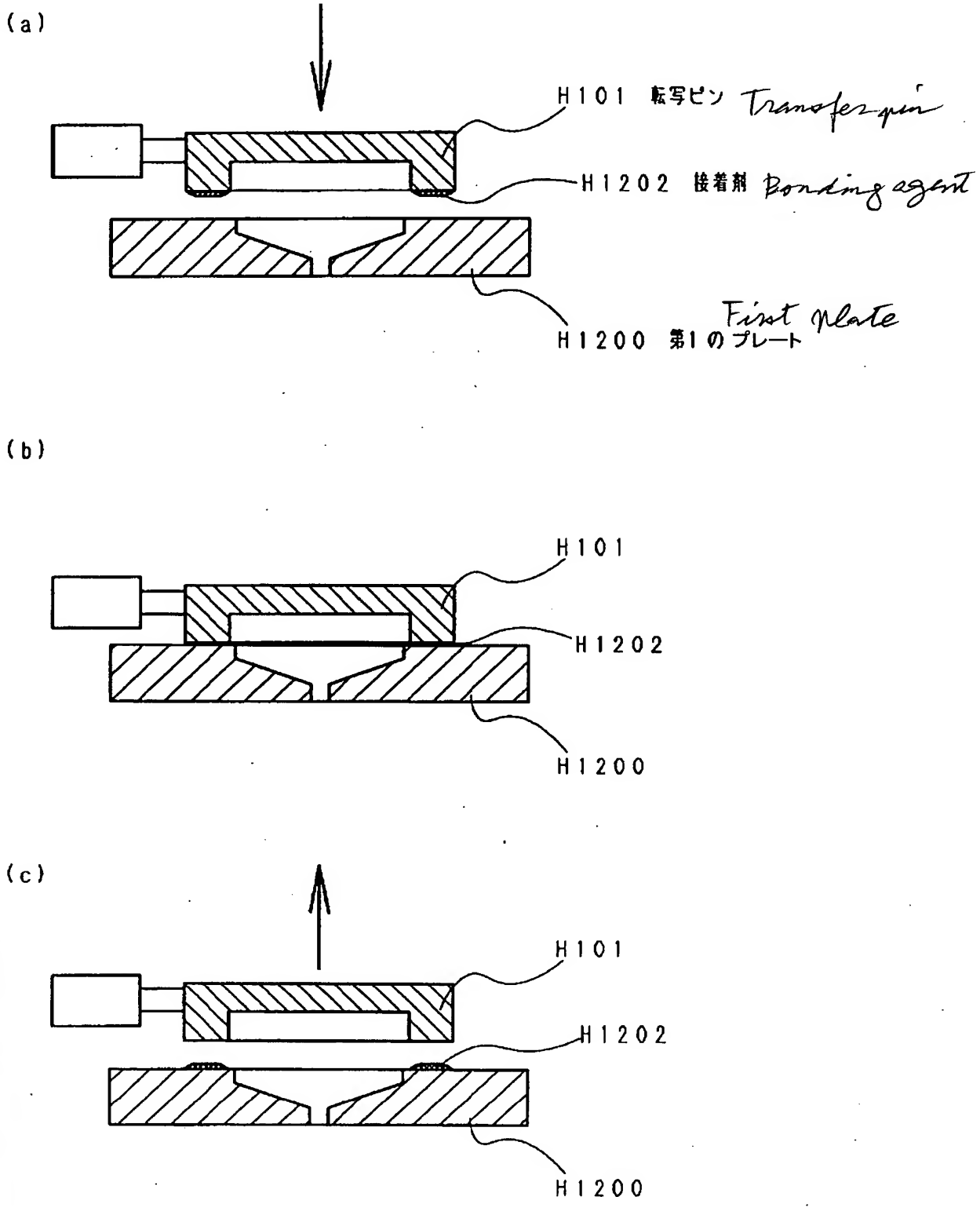
【図８】　Fig. 8



【図９】　Fig. 9

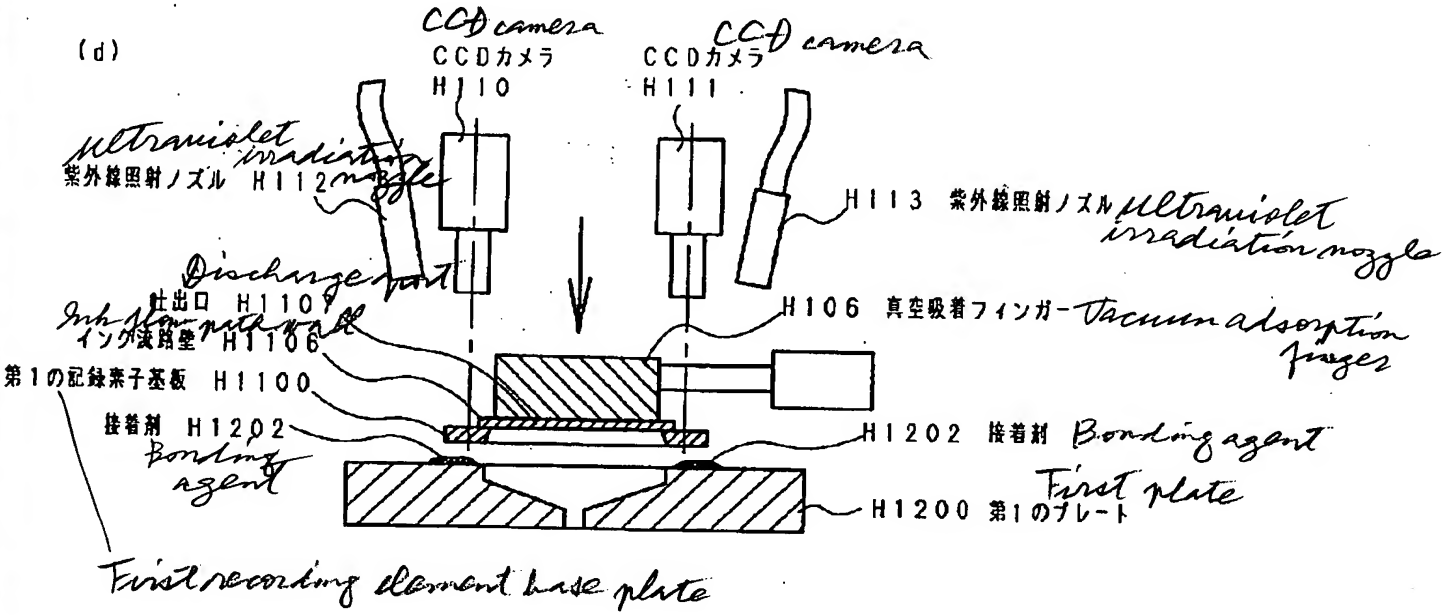


【図１０】　Fig-10

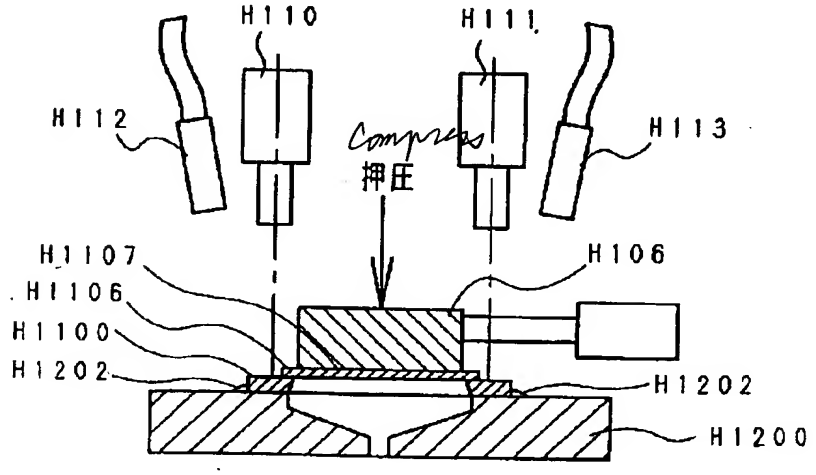


【図１１】　Fig. 11

(d)

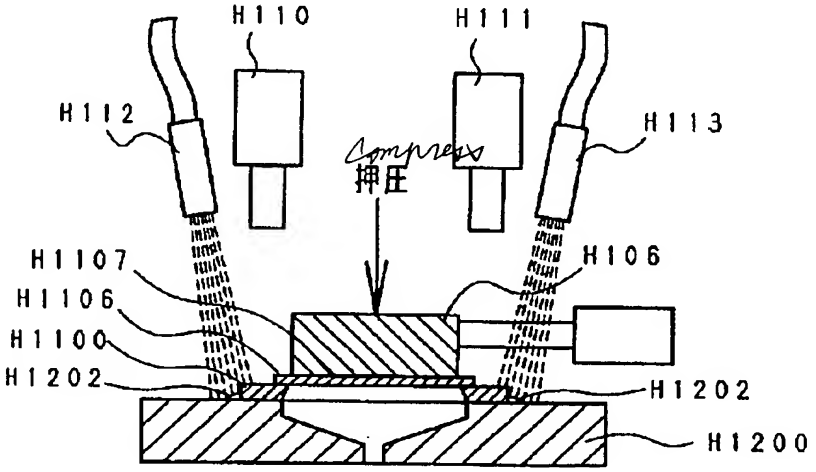


(e)

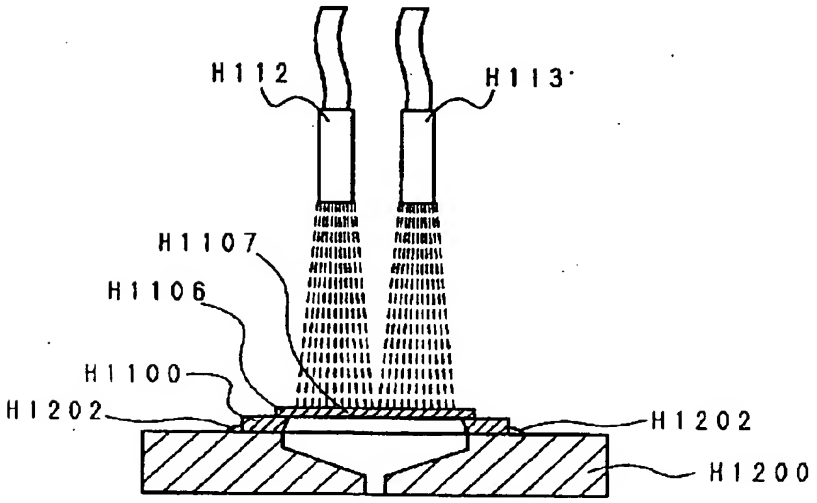


【図１２】 Fig. 12

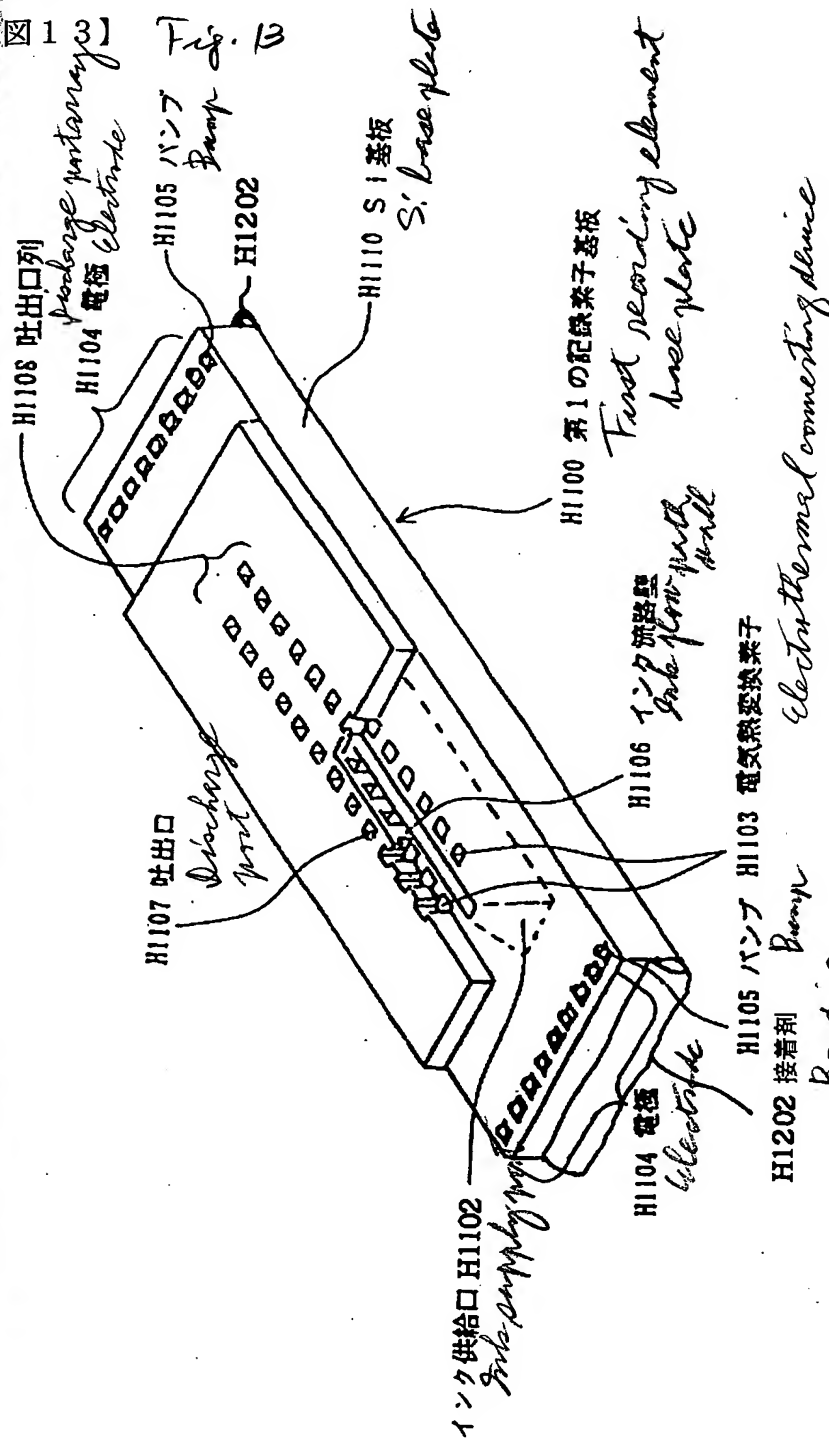
(f)



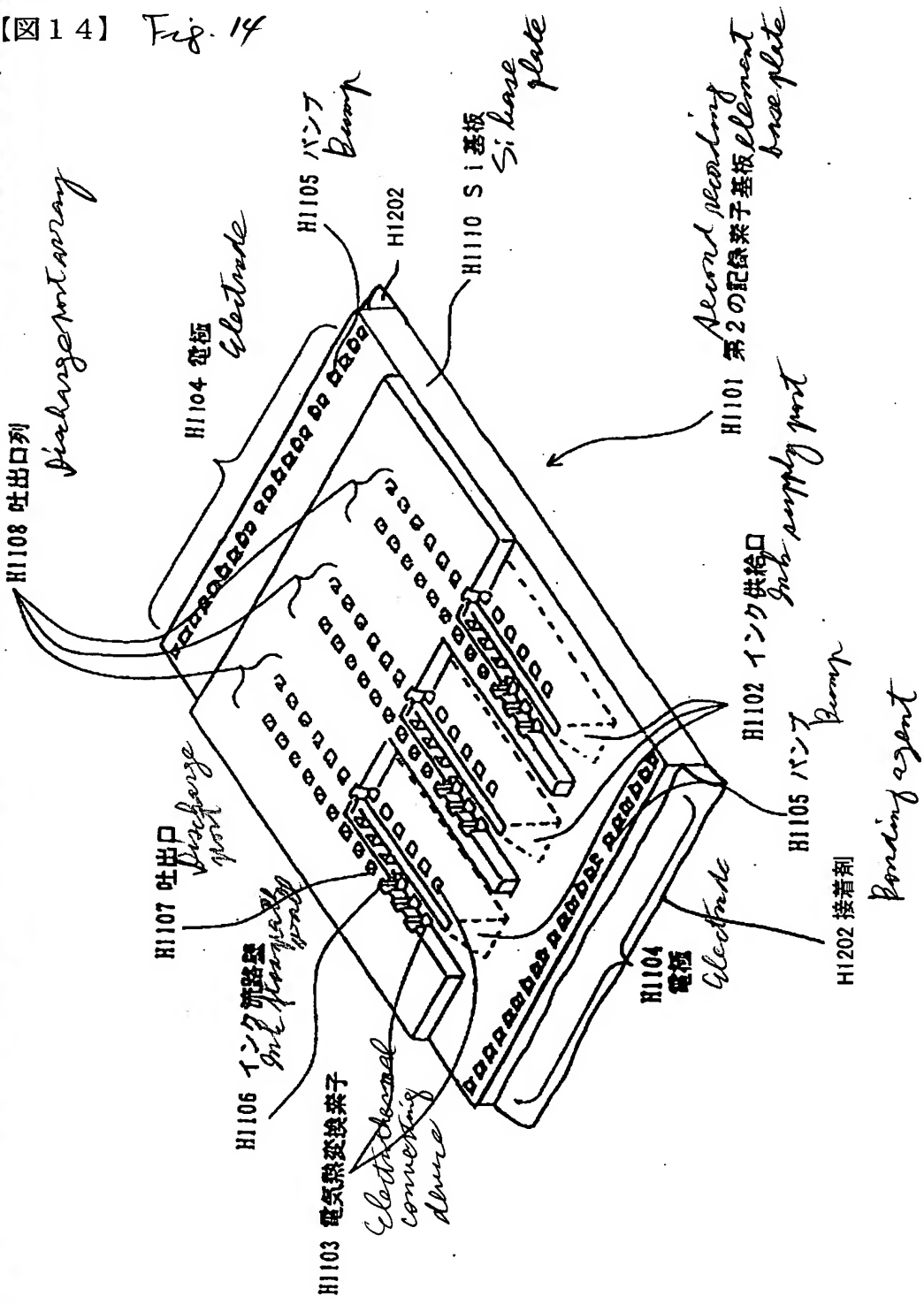
(g)



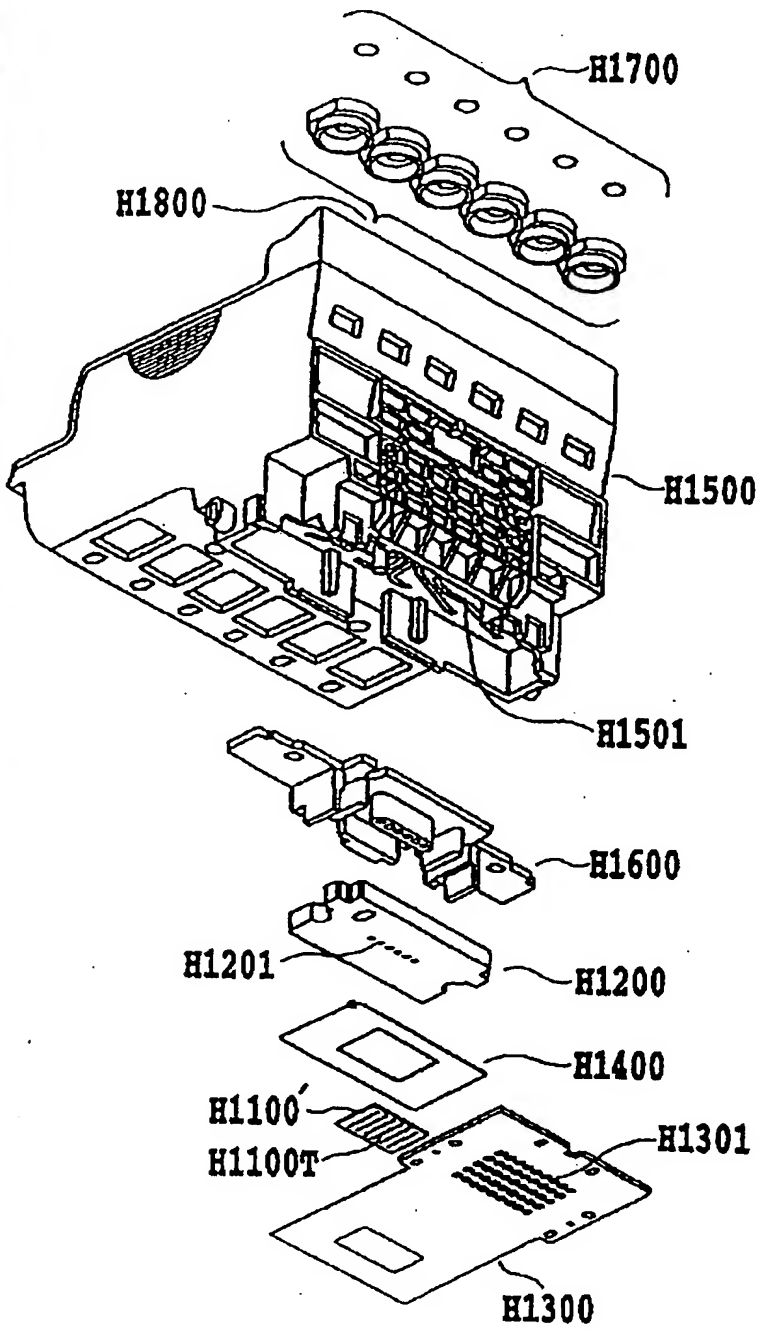
【図１３】 Fig. 13



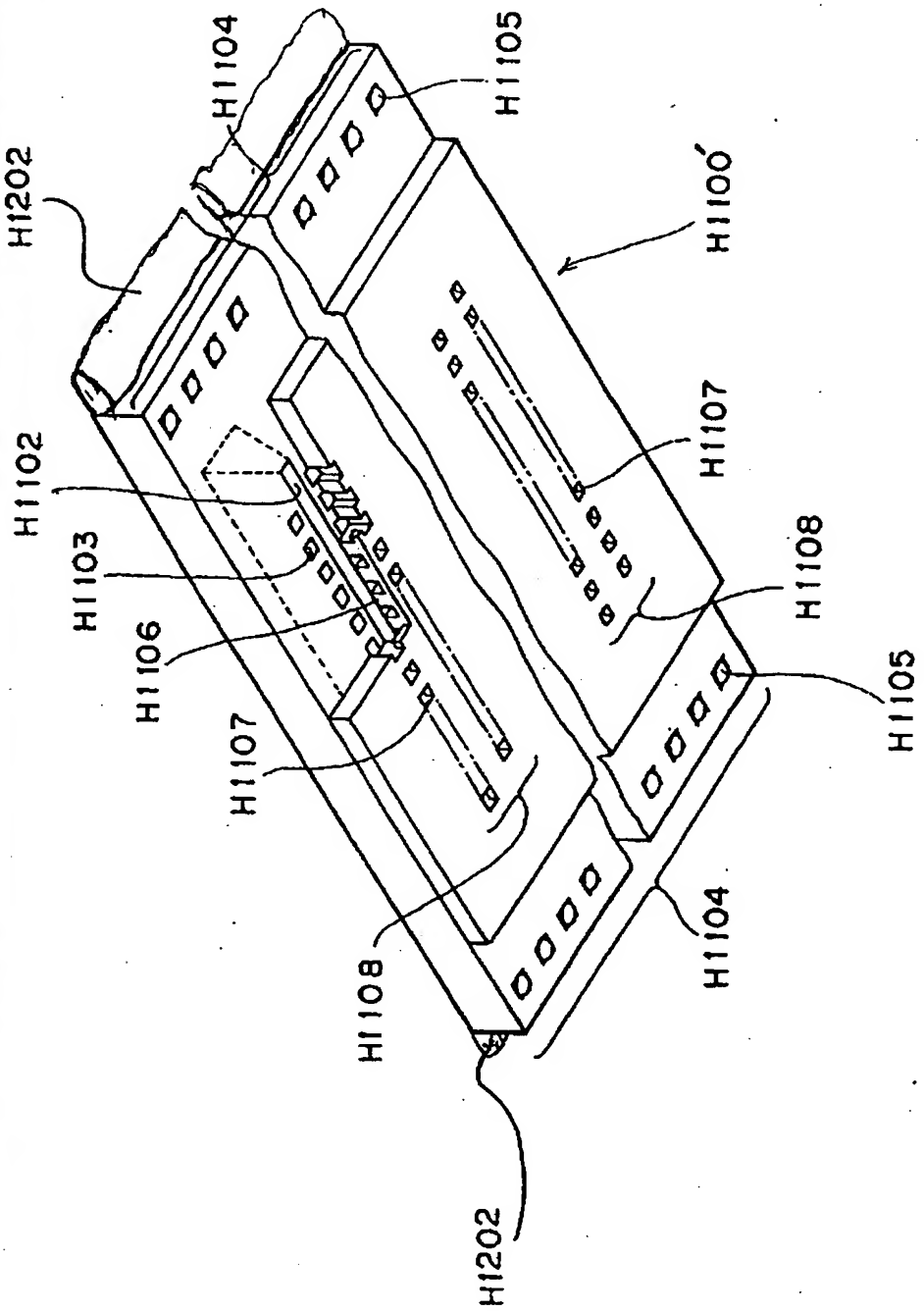
【図１４】 Fig. 14



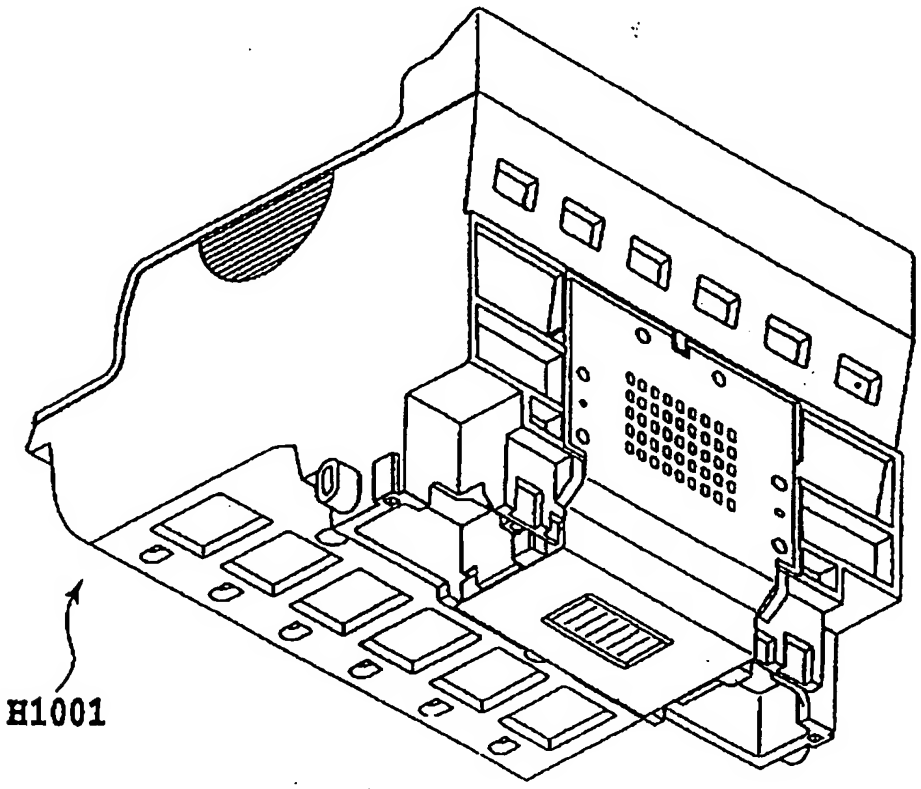
【図１５】 Fig. 15



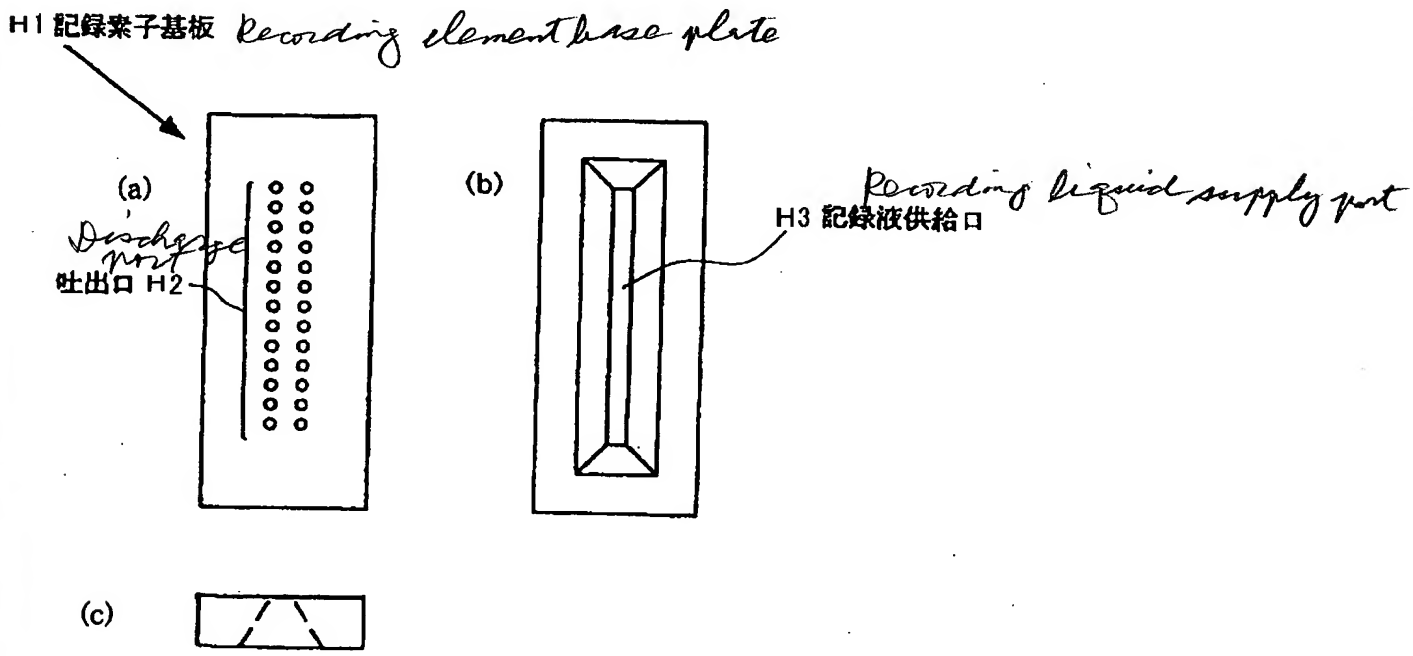
【図１６】 Fig. 16



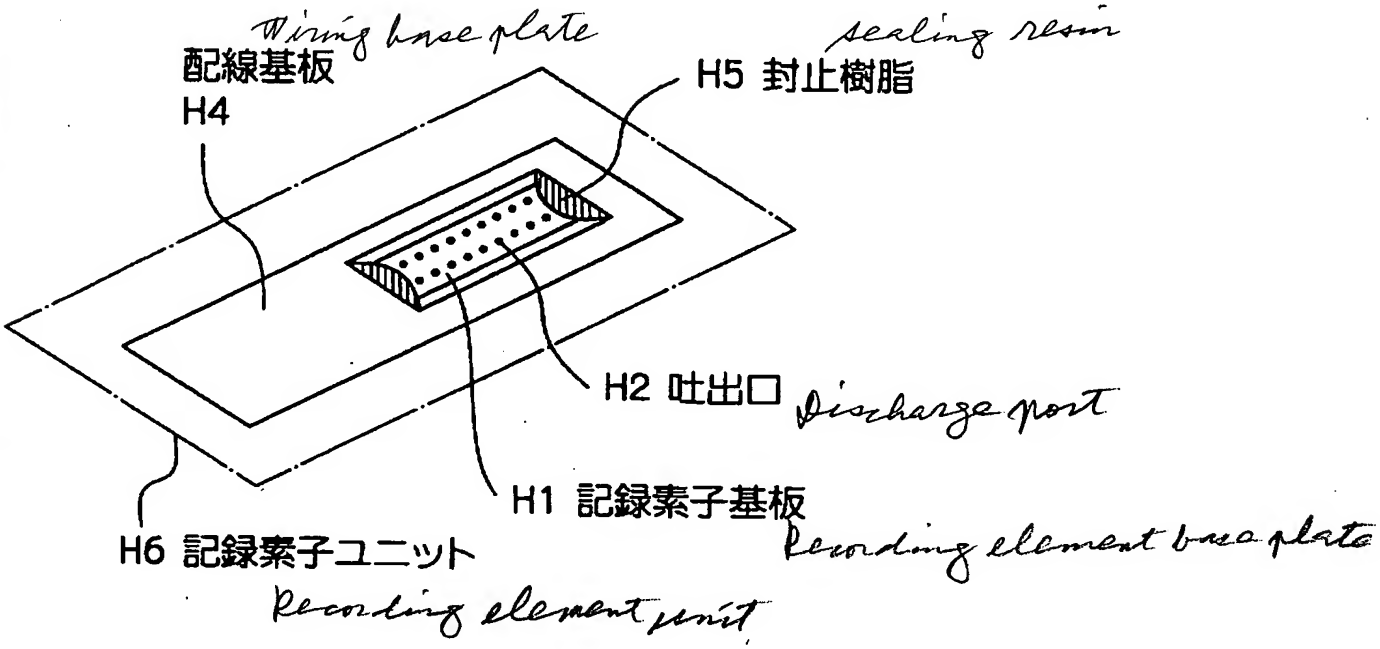
【図１７】 Fig. 17



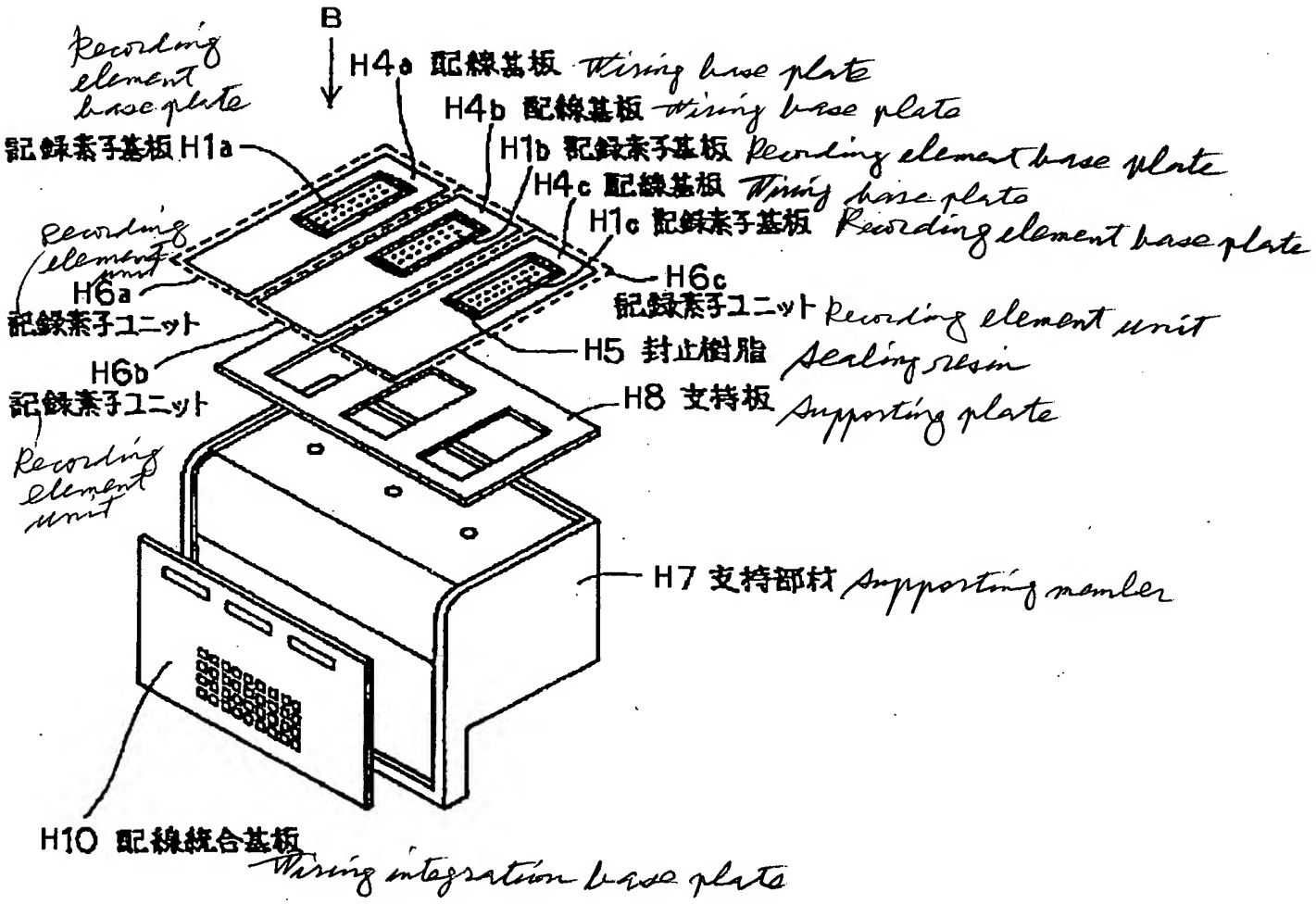
【図１８】 Fig. 18



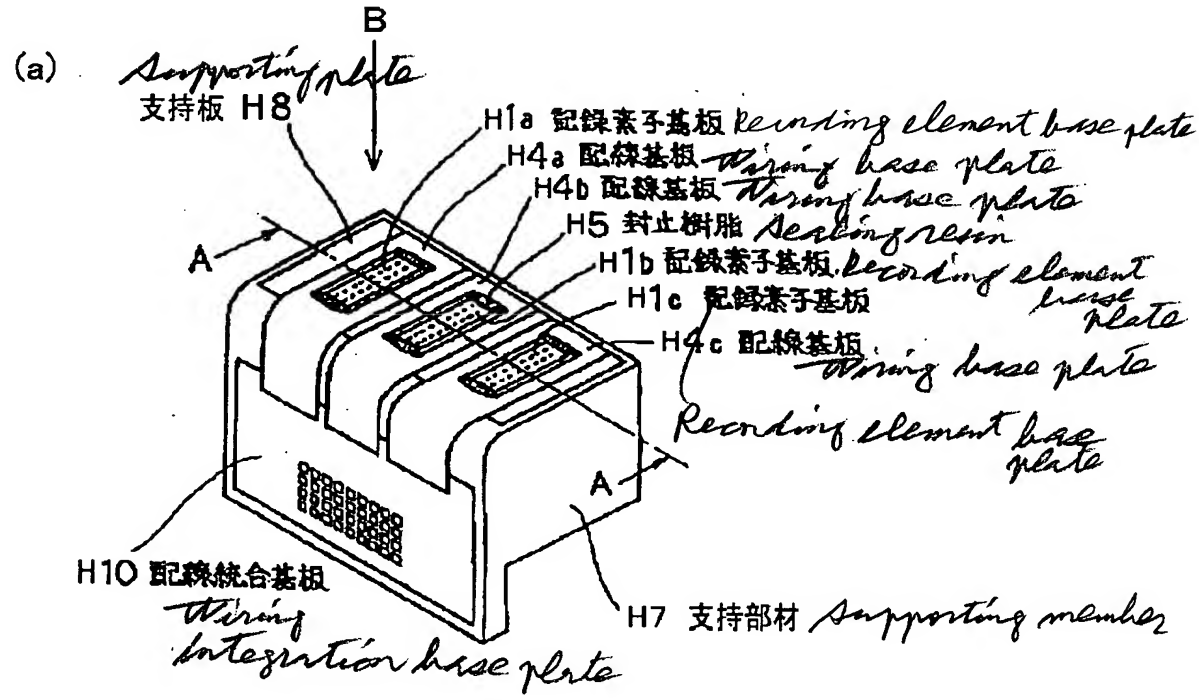
【図１９】 Fig-19

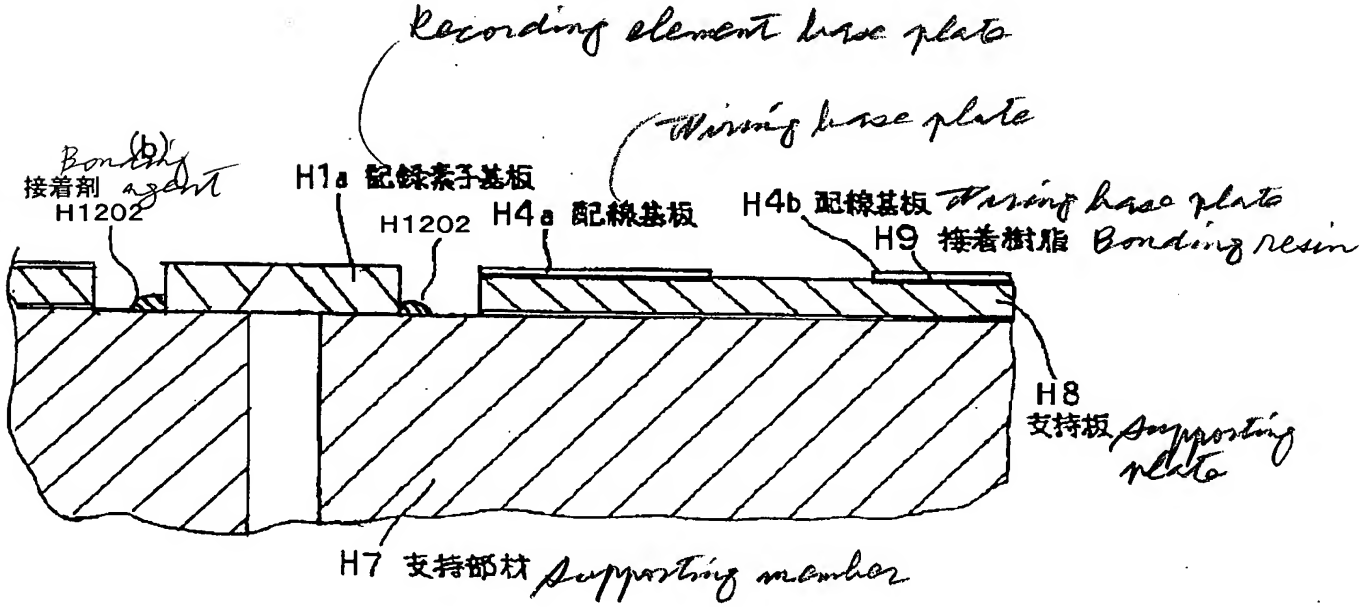


【図２０】 Fig 20

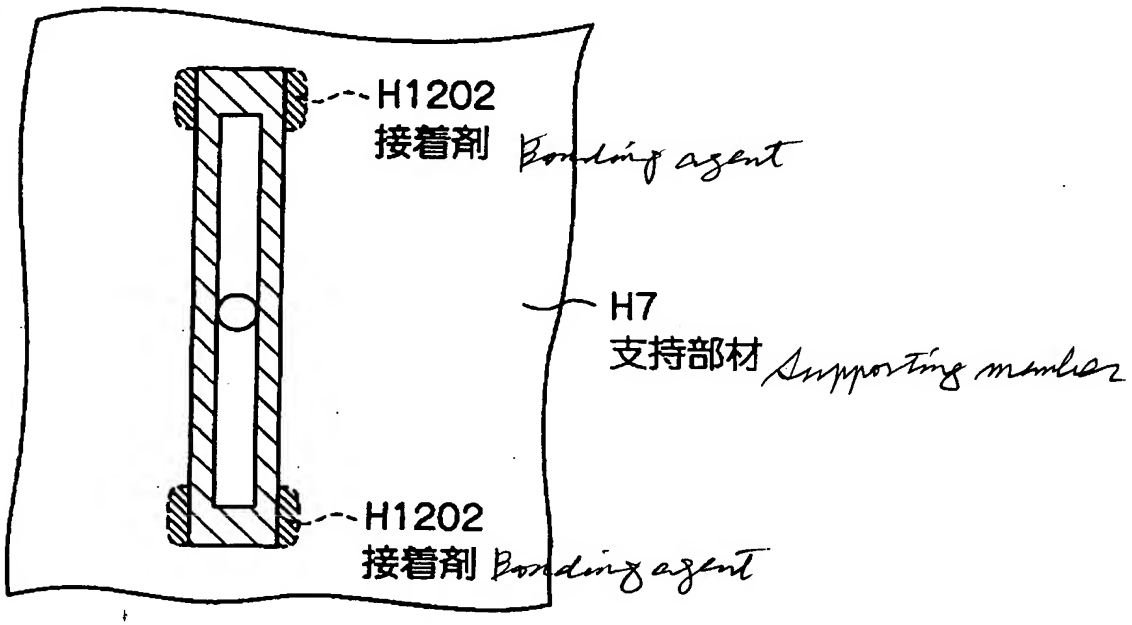


【図２１】 Fig 21

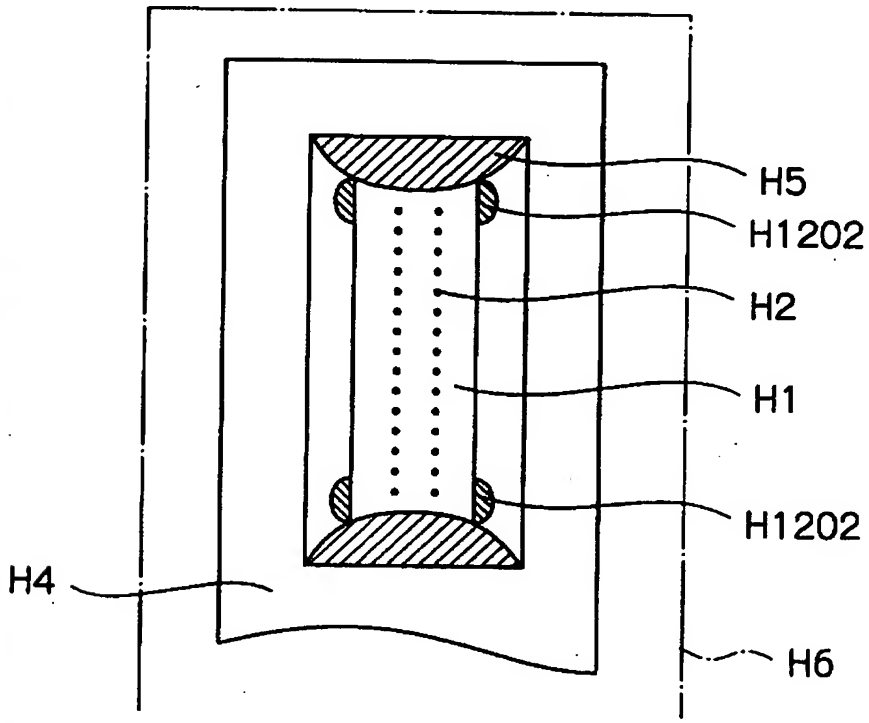




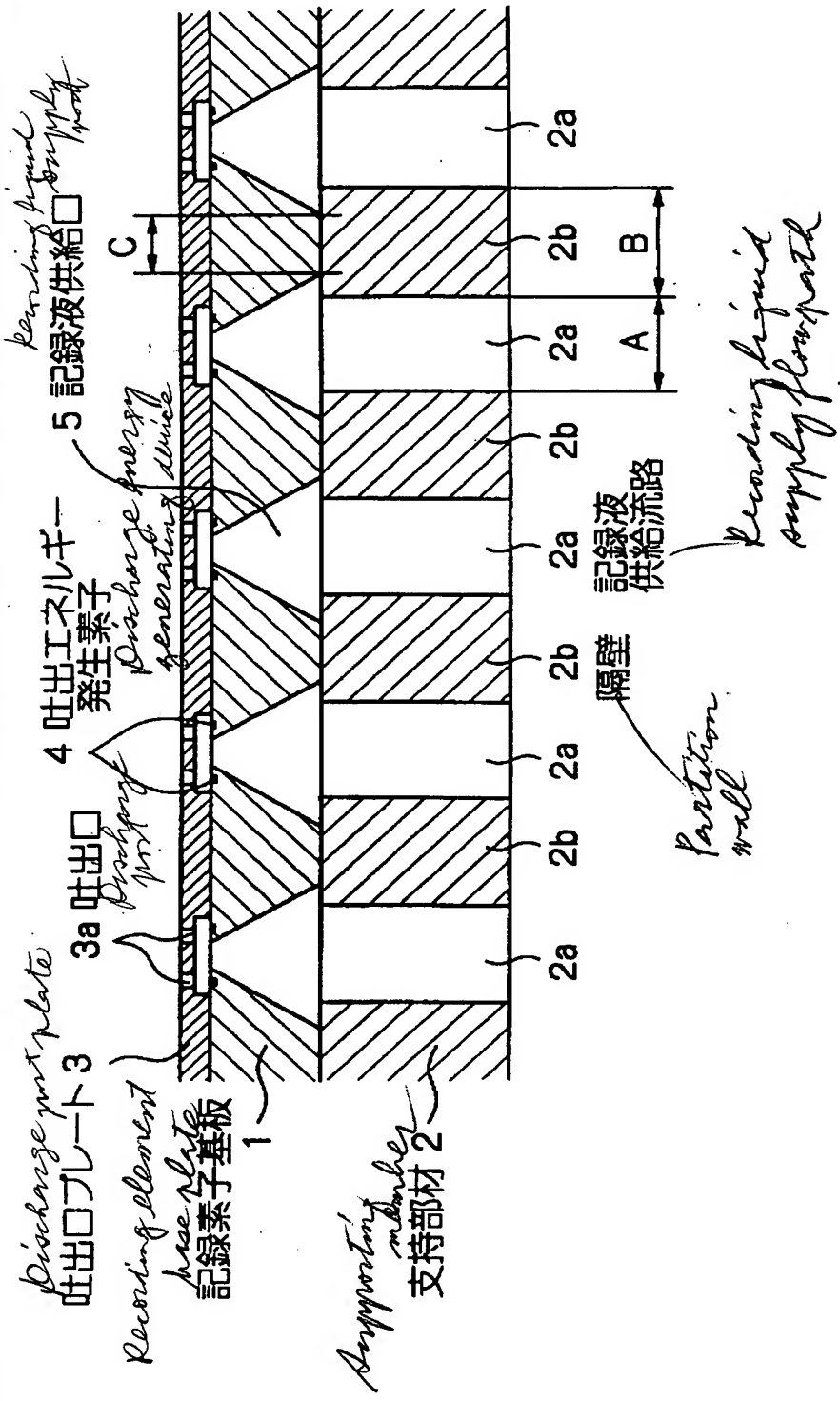
【図２２】 Fig. 22



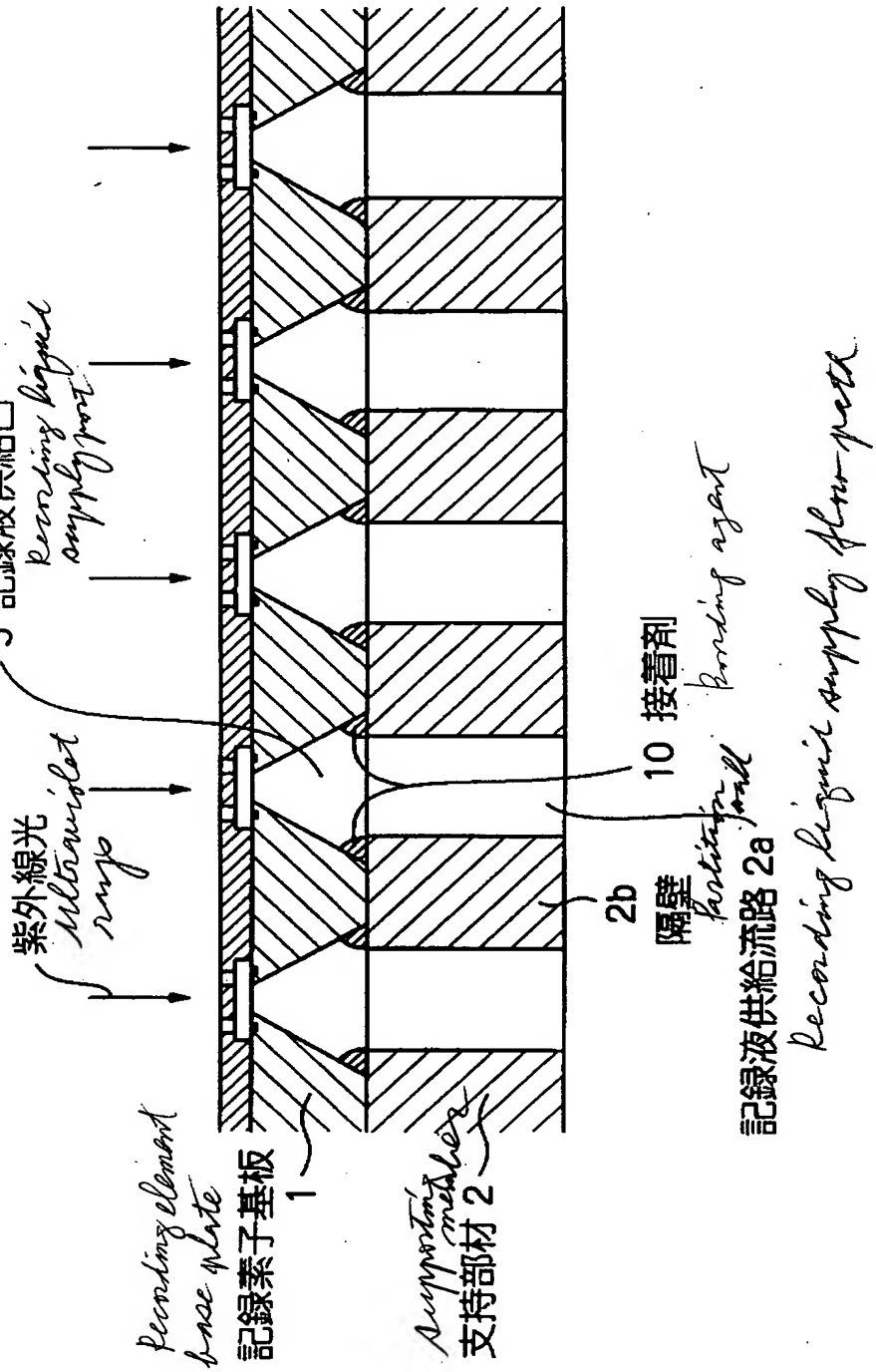
【図２３】 Fig. 23



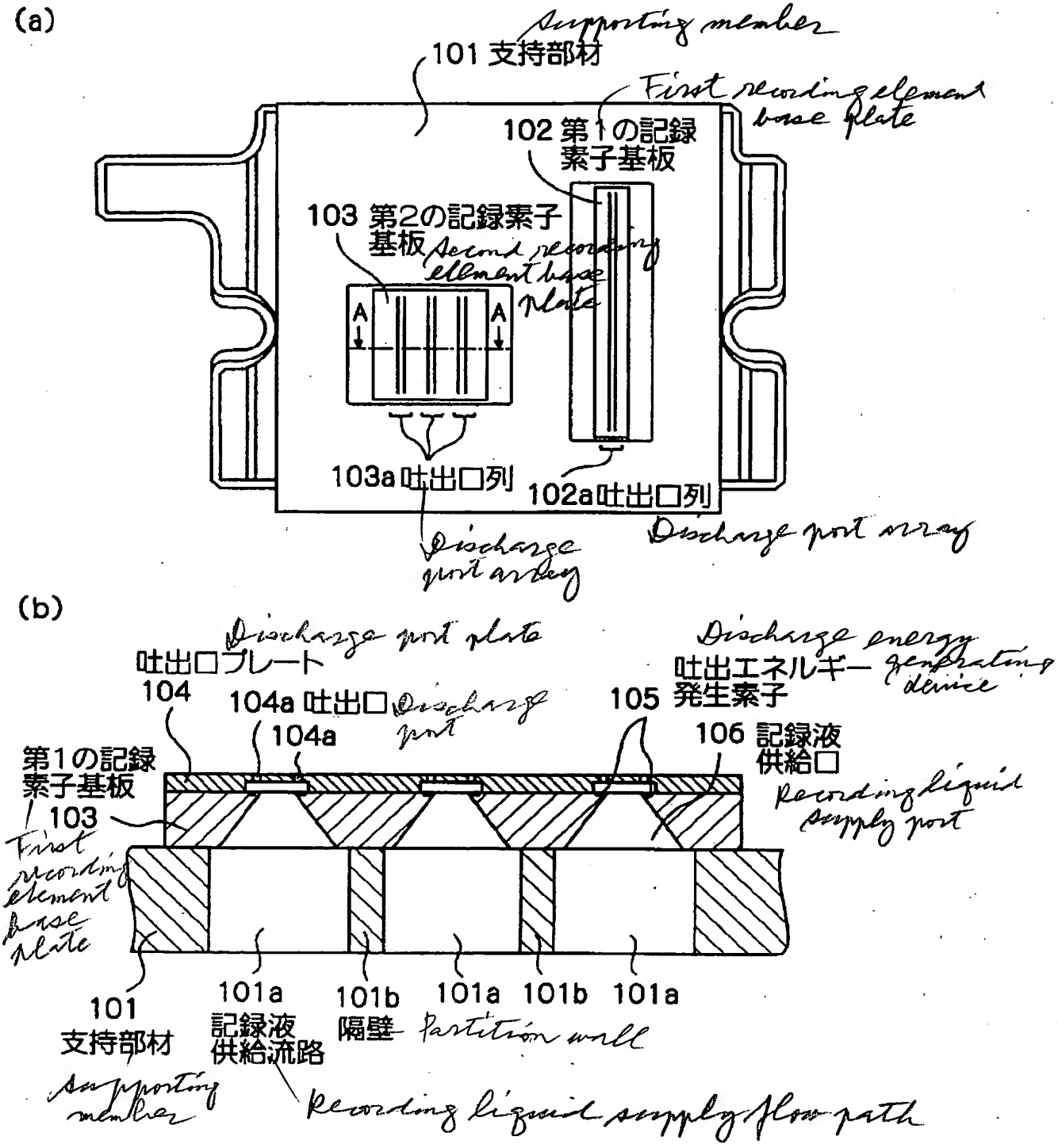
【図２４】　Fig. 24



【図２５】 Fig. 25



【図２６】 Fig. 26



[Name of the Document] Abstract

[Abstract]

[Object]

An object of the present invention is to optimize the discharge characteristics of recording liquid and the supply characteristics thereof, as well as the positioning precision of a recording element base plate to a supporting member when discharge port arrays are arranged at a high density.

[Means for Achieving the Object]

An ink jet recording head has a plurality of discharge energy generating devices 4 for discharging recording liquid, while being provided with a recording element base plate 1 arranged on the face opposite to the surface where the devices 4 are arranged, having a plurality of recording liquid supply ports 5 for supplying recording liquid to the devices 4, as well as with a supporting member 2 that holds and fixes the recording element base plate 1. For the supporting member 2, a plurality of recording liquid supply paths 2a are arranged to supply recording liquid to each of the supply ports 5 of the recording element base plate 1, respectively, and then, the flow path width of each supply flow path 2a is formed to be smaller than the opening width of inlet portion of each supply port 4. Further, the steps to be created between the supply flow path 2a and the supply port 5 is buried by the bonding agent 10 forced out

from the bonding face of the recording element base plate 1 and the supporting member 2.

[Elected Drawing]

Figure 25

Applicant's Information

Identification No. [000001007]

1. Date of Change: August 30, 1990

(Reason of Change) New Registration

Address: 3-30-2, Shimomaruko, Ohta-ku, Tokyo

Name: CANON KABUSHIKI KAISHA